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THIRTY-SECOND ANNUAL REPORT

ON THE

NEW YORK STATE MUSEUM OF NATURAL HISTORY

BY THE

REGENTS OF THE UNIVERSITY

OF THE

STATE OF NEW YORK.

TRANSMITTED TO THE LEGISLATURE MARCH 10, 1879.

ALBANY:  
CHARLES VAN BENTHUYSEN & SONS.  
1879.



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STATE OF NEW YORK.

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No. 89.

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IN ASSEMBLY,

MARCH 10, 1879.

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YORK.

UNIVERSITY OF THE STATE OF NEW YORK: }  
OFFICE OF THE REGENTS, }  
ALBANY, *March 10, 1879.* }

To the Hon. THOMAS G. ALVORD,

*Speaker of the Assembly:*

SIR—I have the honor to transmit the Thirty-second Annual Report on the State Museum of Natural History by the Regents of the University.

I remain, very respectfully,

Your obedient servant,

E. C. BENEDICT,

*Chancellor of the University.*



# REGENTS OF THE UNIVERSITY.

[*Ex-Officio Trustees of the State Museum of Natural History.*]

---

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DANIEL J. PRATT, PH. D., ASSISTANT SECRETARY.

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## STANDING COMMITTEE ON THE STATE MUSEUM, 1879:

THE VICE-CHANCELLOR,	MR. CLINTON,
THE SECRETARY OF STATE,	MR. BREVOORT,
THE SUPT. OF PUBLIC INSTRUCTION,	MR. BOSTWICK,
	MR. SMITH.

## Director of the Museum:

JAMES HALL, LL. D.

## Assistants in the Museum:

J. A. LINTNER, IN ENTOMOLOGY AND GENERAL ZOÖLOGY.  
JAMES W. HALL, IN OSTEOLOGY AND THE PREPARATION OF ROCK SECTIONS.  
CHARLES H. PECK, A. M., BOTANIST,  
JAMES A. HURST, TAXIDERMIST.



# REPORT.

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*To the Honorable the Legislature of the State of New York :*

The Regents of the University, as trustees of the State Museum of Natural History, respectfully submit this their Thirty-second Annual Report.

The condition of the Museum, and the work of the last year, are exhibited in the reports of the Director and of the Botanist hereto appended.

Respectfully submitted in behalf of the Regents,

E. C. BENEDICT,

*Chancellor of the University.*

S. B. WOOLWORTH,

*Secretary.*

ALBANY, *March* 10, 1879.



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REPORT

ON THE

STATE MUSEUM OF NATURAL HISTORY.

1879.

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By JAMES HALL, LL. D., Director.

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## REPORT OF THE DIRECTOR.

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ALBANY, *January*, 1879.

*To the Honorable the Board of Regents of the University of the State of New York :*

GENTLEMEN — I have the honor to communicate herewith the Annual Report of the State Museum of Natural History, giving some general account of the conditions of the collections in the several departments, the additions which have been made, and the work done in the Institution during the past year ; together with special communications upon subjects under investigation by persons connected with the Museum.

I am able to report that the collections of the Museum in every department are in good condition, and satisfactorily arranged for the purposes of examination and study. The labeling and rearrangement of the geological collection, which in my last report I mentioned as in progress, has been completed, and the entire series is now presented in satisfactory order.

The want of room for the arrangement of the rapidly increasing collections in geology and palæontology is every year more severely felt by the Director and by those aiding in the work. Under existing circumstances it is quite impossible to present any tangible evidence of the progress of our work, and it is nearly impracticable to find the means of putting on exhibition any portion of the collections which have been made, or specimens which have been specially prepared for the Museum during several years past. We are also suffering many inconveniences for the want of proper working rooms attached to the Museum, where the work of progress in all departments could be witnessed by the trustees, and by any parties interested in the prosperity of the Institution.

I beg to repeat what I have said in a previous report, that we need at this time, for the proper exhibition of the geological and palæontological collections acquired during the past few years, a space equal to another story or floor of the same area as those of the present Museum ; while also the crowded condition of the skeletons and osteological collections is such that we need as much more space as is now occupied by them.

I call attention to these points, while knowing that it is not, at present, in the power of the Regents to grant any relief, but in order that they may appreciate the necessity which exists of doing much of the work beyond the walls of the Museum building.

In the general zoölogical arrangement, it is a matter of very great interest and importance that the collection of birds should be rearranged, the wanting species supplied, and the whole collection labeled according to the present state of our knowledge of the subject. Beyond this, moreover, some new information is desirable regarding the general and local distribution, the migration, habits, breeding, etc., of the birds which are known as the birds of New York, as well as of those which only pass through the State in their migrations north and south. While so much attention is being given to this subject in some of the States, and especially in the Western States and territories, it is scarcely becoming that a State which gave the lead in such investigations, and in the diffusion of a knowledge of natural history, should any longer remain inert in this special department of natural science.

I shall have the pleasure of presenting to your honorable body a special communication upon this subject, from which you will be able to learn in a more satisfactory manner the nature of the work to be done, and which when done will give an important rank to our ornithological collection, which at present is of little value to science. At the same time, the facts thus obtained and published will be a valuable source of information to the people of the State.

Details of the additions to the Museum in its several departments will be found appended. The donations have been unusually few during the past year.

To the Botanical department contributions have been received from seventeen persons, making in all fifteen hundred and fifty-two species.

To the Zoölogical department contributions have been made by twelve persons.

To the Ethnological department two contributors only are recorded.

In this department, contributors to the Museum have greatly diminished in number during the past few years, from the fact that such subjects have come to have a pecuniary value; and, also, that there are numerous collectors and institutions in the State who are competitors with the State Museum.

This condition of things will continue; and if it be thought desirable to increase the collections in this department, it will be necessary to make special collections, or to purchase from those who have made them. Several offers of the sale of collections have been made to the Museum during the year, but having no means at our disposal for such purposes, no present encouragement has been given to the applicants.

To the Mineralogical and Palæontological department four donors are recorded.

To the Library, contributions have been made by twenty societies and eight individuals, of twenty-three bound volumes, and eighty-nine in paper covers and pamphlets, all but thirteen of these being serials. From all sources, the additions to the Library have been forty-two bound volumes, and of volumes in paper and pamphlets (chiefly serials), one hundred and forty-one.

A donation of the extensive botanical collection of the late Dr. Anthony Gescherdt has been kindly made to the Museum by Madame Gescherdt, through Hon. Alexander Thain, of New York. The collection contains 1,479 species, all of which are labeled. These are chiefly European species, but there are some from the United States, the West Indies, etc. A list of the species, as they were arranged in the twenty-two packages when received, has been made by Mr. Peck. This list, when fully classified, will be communicated with the report upon the State Museum.

#### GENERAL WORK OF THE MUSEUM.

In the Botanical department the accompanying report of the Botanist, Mr. C. H. Peck, will indicate the work done by himself, and the addition to the Herbarium of one hundred and sixty-five mounted species of plants which were not previously represented in the collection.

To the Zoölogical department some interesting specimens of worms, insects, crustaceans and fishes have been added, through the collections of Mr. Lintner, at Caledonia creek, made at the request of the State Commissioners of Fisheries. Such of the animal forms as could be obtained during the winter season at this interesting locality, were carefully collected and critically studied, with especial reference to their value as fish food, and the practicability of their transplantation into other streams of the State which are less prolific in the forms so remarkably abundant at Caledonia. The results of this examination have been published in the Tenth Annual Report of the State Commissioners of Fisheries.

The alcoholic collection of specimens has been in part relabeled, the jars replenished with fresh alcohol, and the recent donations and collections incorporated.

To the Osteological collection there have been added about fifty specimens, including thirty-three prepared skulls.

A large number of recent shells have been cut into sections for illustrating their internal structure, and about one hundred specimens of this character have been added to the collection.

The additions to the Ethnological collections, filling nearly two cases, have been arranged and labeled. The series of Table-cases, containing stone or Terra-cotta specimens, occupies one hundred and thirty-six square feet of area. Several additional cases are necessary for a proper exhibition of the material.

In the Mineralogical department additional work has been done upon the general collection, by the incorporation of other material belonging to the Museum. The arrangement and labeling has been completed, and the collection is now ready for cataloguing.

A series of Volcanic rocks and minerals, from the Van Rensselaer collection, has been labeled and arranged in three Table-cases.

The Emmons collection of crystallized minerals has been fully labeled, in conformity with the other mineralogical collections. A considerable number of duplicate minerals, derived from various sources, still remain in the drawers.

The work of rearranging and labeling the geological series contained in the wall cases of the first floor, which was in progress at my last report, has been completed during the year. The collection is now accessible for examination and study. The smaller specimens have been mounted, uniformly with the mineralogical collection. The labels indicate the number of the specimen, its geological position, name, contained fossils in many instances, and locality. This collection is especially intended to illustrate the geological formations of the State, exclusive of the palæontological collections, and some idea may be formed of the extent to which this object is carried, by a glance at the schedule below, which shows the number of labeled specimens in each formation:

System.	Group.	Formation.	No of specimens.
Laurentian .....	Lower .....		99
	Upper.....		101
Huronian .....			84
	{ Potsdam .....		60
{ Lower Silurian.	{ Quebec.....	{ Calciferous Sandstone .....	65
{ (Cambrian of		{ Shales and Sandstone .....	108
{ Sedgwick)....		{ Chazy Limestone .....	70
	{ Trenton .....	{ Birds-eye Limestone .....	45
		{ Black-river Limestone ....	32
		{ Trenton Limestone .....	122
	{ Hudson River.....	{ Utica Slate .....	55
		{ Hudson-river Shales.....	101
		{ Gray Sandstone .....	15
		{ Shawangunk Conglomerate,	15
		Medina Sandstone .....	100
	{ Clinton .....		110
Middle Silurian....	{ Niagara .....	{ Niagara Shaly Limestone..	105
		{ Guelph.....	10
		{ Coralline Limestone.....	32
	{ Onondaga Salt.....		110
Upper Silurian.....	{ Waterlime.....		58
		{ Tentaculite Limestone .....	47
	{ Lower Helderberg....	{ Lower Pentam. Limestone,	56
		{ Shaly Limestone .....	109
		{ Upper Pentam. Limestone..	15

System.	Group.	Formation.	No. of specimens.
		Oriskany Sandstone.....	86
		{ Cauda-galli Grit.....	23
		{ Schoharie Grit.....	51
	{ Upper Helderberg	{ Onondaga Limestone.....	30
		{ Corniferous Limestone.....	92
		{ Marcellus Shale.....	67
Devonian.....	{ Hamilton .....	{ Arenaceous and other Shales,	146
		{ Tully Limestone.....	59
		Genessee Slate.....	14
	Portage .....		75
	Chemung .....		149
	{ Catskill .....		74
Carboniferous .....			73
	New Red Sandstone...		47
Quaternary.....			90

A colored Geological Section, exhibiting the order of succession of the New York formations, has been placed above the wall-cases, extending around the room, and so arranged that the representation of the succession of the formations corresponds with the series in the cases. The section is distinctly lettered with the names and subdivisions of each formation, and, in connection with the series immediately beneath it, affords a source of instruction to the student or amateur which has not before been presented in the Museum.

#### DUPLICATE COLLECTIONS OF FOSSILS AND MINERALS.

Pursuant to the direction of the Secretary of the Board of Regents, one of the duplicate series of specimens prepared for the Normal Schools has been sent to the State Normal and Training School at Cortland. Six of the Normal Schools of the State have now received the collections; others still remain, subject to application to the Board of Regents, and their direction.

#### COLLECTIONS IN THE FIELD.

Extensive collections have been made in the field during the past season. In the western part of the State, during May and June, Mr. C. D. Walcott, assisted by Mr. Vandeloo, made large collections of corals and other fossils from the upper Helderberg limestone and the Hamilton group. At a later period Mr. Walcott continued collecting, especially fossil corals, in the limestones of Genesee and Erie counties; and also in the same limestones in Canada West, and at Kelly's Island in Lake Ontario.

During the months of July and August, Dr. J. W. Hall, assisted by Martin Sheehy, made extensive collections, chiefly of fossil corals, from the Upper Helderberg limestones of Albany county. Dr. Hall has also made a geological examination along the Hudson river as far as Poughkeepsie, making sections and extensive and instructive collections of the rocks from fifty-one localities. These collections will be of important aid in the study of the rocks of the Hudson River Valley, and in the determination of their geological age and relations.

The entire collections made during the past season will number at least thirty thousand specimens.

The work of cutting sections of rocks and fossils, chiefly of the latter, has been continued with great success; and the machinery, and work of this kind,

have become a necessity in the Museum organization. A large amount of work has been done in cutting and preparing transparent sections of corals, stromatopora, sponges, etc. Between three and four hundred specimens have been prepared. About one hundred and fifty specimens of corals, orthoceratites and other fossils have been ground and polished, to show the internal structure. So long as the fossils of the Museum are being studied and illustrated, this machinery will be of constant and important use.

In addition to the work of cutting and preparing sections of fossils, the machinery has been applied to the cutting of recent shells, and more than one hundred specimens have been prepared, giving a most instructive exhibition of the internal structure. Preparations of this kind are of the greatest interest and importance in the study of the characters of recent shells, especially of the Gasteropoda, and this collection cannot fail to be appreciated by every student of natural history who visits the State Museum. This department is under the management of Dr. J. W. Hall.

The extensive collections made during 1877, and already communicated in a previous report, have been partially examined, and selections made as far as practicable, and as far as we have drawers for their reception. The large collection of Niagara fossils from Waldron, made in that year, has been unpacked and cleaned, the species separated, and a large part of them ticketed. The Bryozoa of this collection have been carefully studied, in connection with those of the Lower Helderberg group, by Mr. G. B. Simpson. Mr. C. E. Beecher has also spent a much longer time upon the Waldron collection in the careful study and separation of the species of all the other classes, and the selection of a large series for the State Museum collections.

Although these collections are now arranged in drawers, it will be necessary to repack a considerable portion for want of proper accommodations. In the meantime many new species have been selected and determined, which will be illustrated and described in future reports of the Museum.

The large collections from the Lower Helderberg limestone have furnished many new species, which will be included in the plates now being lithographed for the Palæontology of the State.

In conclusion, I beg leave to say, that the field collections in Geology and Palæontology, and the work done upon them in preparing specimens for the Museum and for study, is in every way satisfactory, and more than equals my expectations. I would therefore most earnestly, and respectfully, urge upon the Board of Regents the desirableness and importance of continuing the same system of work, and in the same hands, for the ensuing year.

I am, very respectfully, your obedient servant,

JAMES HALL,

*Director of the State Museum.*

## ADDITIONS TO THE STATE MUSEUM DURING THE YEAR 1878.

### I. BOTANICAL.

A specimen of *Solidago virgaurea* L. From Prof. P. A. PEISSANT, Troy, N. Y.  
Seven flowering plants; two new to the State Herbarium. From ADDISON BROWN, New York.

Specimens of *Cynophallus caninus* Fr. From H. A. WARNE, Oneida, N. Y.  
Two rare Fungi—*Polyporus Morgani* Frost and *Agaricus Morgani* Peck.  
From A. P. MORGAN, Dayton, O.

*Polyporus tomentosus-quercinus* Johns. From A. M. JOHNSON, Minneapolis, Minn.

*Podaxon Warneri* Peck. From W. F. BUNDY, Sauk City, Wis.

*Lentinus Lecontei* Fr. and *Lycoperdon leprosum* B. & R. From H. W. RAVENEL, Aiken, S. C.

*Zygadenus glaucus* Nutt. From L. M. UNDERWOOD, Syracuse, N. Y.

*Listera australis* Lindl. and *Botrychium simplex* Hitch. From Rev. H. WIBBE, Oswego, N. Y.

*Micromitrium Austinii* Sulliv. From C. A. AUSTIN, Closter, N. J.

*Salix petiolaris* Sm. From M. S. BEBB, Fountaindale, Ill.

*Trametes suareolens* Fr. and *Polyporus cuticularis* Fr. From W. C. STEVENSON, Philadelphia, Pa.

Six species of flowering plants; one new to the State Herbarium. From S. H. WRIGHT, M. D., Penn Yan, N. Y.

Twenty-three species of Fungi. From J. B. ELLIS, Newfield, N. J.

Three species of flowering plants and ten species of Fungi; eight species new to the State Herbarium. From Hon. G. W. CLINTON, Buffalo, N. Y.

Nine species of Fungi. From E. A. RAU, Bethlehem, Pa.

One hundred and sixty-five species of plants, new to the State Herbarium.  
Collected by the Botanist, C. H. PECK.

A collection of 1,479 species of plants, principally European, made by Dr. Anthony Gescherdt.

### II. ZOÖLOGICAL.

Right mandible of the lower jaw (13 ft. 4 in. long) of a Greenland whale (*Balaena mysticetus*), which floated ashore at Rockaway Beach in 1875.  
From E. GEE, Albany, N. Y.

A blunt-nose shiner—*Vomer setapiumis* (Mitch.). New York coast. From J. B. HOTALING, Albany, N. Y.

A gold-fish—*Cyprinus auratus* L., with greatly enlarged abdomen from an ovarian tumor; length of body, 9.5 inches; circumference, 11.5 inches.  
From EDWARD SEIB, Albany, N. Y.



A hen's egg of abnormal form (*gourd-shaped*). From H. GERMOND, Nassau, N. Y.

Two specimens of Carrara marble honeycombed by a boring sponge—*Cliona sulphurea* Verrill—taken from the hold of a vessel wrecked on the coast of Long Island in 1871. From E. R. McCARTY, Hotel Brunswick, New York, per Prof. D. S. Martin.

*Ascaris*———sp? in 35 examples, taken from a piece (4x4 inches) of a salted codfish. From C. DEVOL, M. D.

An ichneumon-fly — *Rhyssa atrata* (Fabr.). From ANDREW HUTTON, Albany, N. Y.

Eggs (in soil) of the Rocky Mountain locust—*Caloptenus spretus* Thomas. Minnesota. Large spider—*Nephila plumipes*, from Florida. From J. A. LINTNER.

Pupa of *Sphinx* at pupation, Albany, N. Y.

Larvæ (4) of *Samia Cecropia* (Linn.), Albany, N. Y.

Larvæ (15) of *Datana ministra* from birch, Albany, N. Y.

Larvæ (4) of *Dryocampa rubicunda* (Sm.-Abb.), New York city.

Larva of *Calodasys unicornis* (Sm.-Abb.), Albany, N. Y.

Larva of *Thyreus Abbotii* Swains., Albany, N. Y.

Larva of *Danaus Archippus* (Fabr.), Albany, N. Y.

Larvæ (5) of *Orgyia leucostigma* (Sm.-Abb.), Albany, N. Y.

Larvæ (25) of *Chironomus* sp., Caledonia creek, N. Y.

Larvæ (33) of Ephemeridæ—*Cloë* sp., Caledonia creek.

Larvæ (3) of *Æschna verticalis*, Caledonia creek.

Larvæ (8) of Limnophilidæ, near *Hallesus* (caddis worms), Caledonia creek. Caddis-worm from a hollowed stem case, Caledonia creek.

Larva-cases (18) of one of the Hydroptikæ, *Phixocoma* sp., Caledonia creek.

Larva-cases (37) of a species of the Limnophilidæ, Caledonia creek.

Larvæ (2) of a Dytiscid beetle—*Gaurodyltes* sp., Caledonia creek.

Pupæ (many) of a fly, from water, Warren Co., N. Y.

Fresh-water craw fish (6)—*Cambarus Bartonii* (Fabr.), Caledonia creek.

Fresh-water shrimp (86) *Gammarus fasciatus* Say.,\* Caledonia creek.

Miller's thumbs (6)—*Cottus gracilis* Heckel, Caledonia creek.

Sticklebacks (23)—*Gasterosteus inconstans* Kirtl., Caledonia creek.

Collection by J. A. LINTNER.

Honey-bees—*Apis mellifica* Linn., drones, workers and (3) queens. From WILLIAM HALL, Middletown, Delaware Co., N. Y.

A red-shouldered buzzard—*Buteo lineatus* (Gm.), taken at Canajoharie, N. Y., Dec. 19th. From A. G. RICHMOND, Canajoharie, N. Y.

*Strombus gigas* Linn. (4) and *Cypræa tigris* Linn. (3), for cutting sections. From JAMES HALL.

A hermit crab—*Eupagurus longicarpus* (Say.), in a new preservative liquid. From ERASTUS CORNING, JUN.

Twenty-three species of Mollusca and one of Vermes, as follows: *Helix Californica* Lea, California; *H. Stearnsiana* Gabb, San Deigo; *H. facta* Newcomb, Santa Catelina; *H. Yatesii* Cooper, California; *H. Bowditch-*

\* For the illustration of, and remarks upon, this and several of the above Caledonia forms, see Report on the Insect and other Animal forms of Caledonia creek.

*iana* Feer., Madeira; *H. delphinula* Lowe, Madeira; *H. undata* Lowe, Madeira; *H. armillata* Lowe, Madeira; *H. erebescens* Lowe, Madeira; *H. Maderensis* Wood, Madeira; *H. polymorpha* Lowe, Madeira; *H. subtilis* Lowe, Madeira; *H. paupercula* Lowe, Madeira; *H. abjecta* Lowe, Madeira; *H. bifrons* Lowe, Madeira; *H. lurida* Lowe, Madeira; *H. Stephenaphora* Dillwyn, Madeira; *H. thiarella* Webb, Madeira; *Stenoradia Magdalensis* Hinds, Cal.; *Ringicula conformis* Montero Sante, Madeira; *Argyope decollata*, Chenu; *Bulinus nigrofasciata* Pfeif., Santa Fe de Bogota; *B. veranyi* Pfeif., Santa Fe de Bogota; *Ditrupa acuta* Hayes. From W. NEWCOMB, M. D., Ithaca, N. Y.

### III. MINERALOGICAL AND PALÆONTOLOGICAL.

Blue calcite; Pitkin, St. Lawrence Co., N. Y. Hexagonite; Edwards, St. Lawrence Co., N. Y. Purchased of P. P. PECK.

Two specimens of Selenite; Yawger's quarries, near Springport, Cayuga Co., N. Y. From Messrs. J. C. & H. YAWGER.

A block of Magnetite, 52x18x20 inches, from the Tilly-Foster Mine, Putnam Co., N. Y. From H. T. DURANT.

Four crystals of Gypsum; Camillus, N. Y. A slab of Gypsum, with crystallized native Sulphur; Marcellus, N. Y. From FREDERICK STAR, Auburn, N. Y.

Rock borings from an Artesian well at Wyoming, N. Y., arranged in a glass tube to show the comparative thickness of the beds traversed. Purchased for the Museum.

The Emmons Collection of Crystals and Crystallized Minerals, principally from Northern New York. (Purchased in 1877, but not included in the list of additions in that year.)

*Columnaria sulcata*; Jefferson Co. (? Theresa), N. Y. From R. S. PALMER, North Lawrence, St. Lawrence Co., N. Y.

### IV. ARCHÆOLOGICAL.

Indian pottery (twelve pieces), Loudonville, Albany county, N. Y.

Indian pottery (fifteen pieces), Guilderland, Albany county, N. Y.

Pieces of chert from a locality in Loudonville, to which they had probably been brought for working into arrow-heads.

Four gun-flints.

Chert chips from an Indian arrow-head locality, near New Albany, Ind. From F. E. ASPINWALL, M. D., Loudonville, N. Y.

A copper hand-axe, of aboriginal manufacture, dug up on the farm of the donor. From E. V. COLLINS, Stuyvesant, N. Y.

Four trays of Indian arrow and spear heads, as follows:

No. 1. Fifteen arrow and spear heads of chert, Loudonville, N. Y.

No. 2. Seventeen arrow and spear-heads of chert, etc., Guilderland, N. Y.

No. 3. Twenty arrow-heads of chert, Guilderland, N. Y.

No. 4. Thirteen arrow and spear heads of chert, etc., near New Albany, Ind.

A piece of sandstone (? a hammer stone) with pittings and excavations on two opposite sides, near West Albany, N. Y.

Deposited in the collection by F. E. ASPINWALL, M. D., subject to call.

V. TO THE LIBRARY.

1. BY DONATION.

- Department of the Interior. Bulletin of the United States National Museum. No. 10. Contributions to North American Ichthyology, No. 2. By David S. Jordan. Washington: 1877. 8 vo., pp. 120, plates 45.
- Do. ————. Bulletin of the U. S. Geological and Geographical Survey of the Territories. Vol. IV, Nos. 1 and 2. Washington: Feb. 5, 1878, and May 3, 1878. 8 vo., pp. 543.
- Do. ————. Miscellaneous Publications, No. 9. Descriptive Catalogue of Photographs of North American Indians. By W. H. Jackson. Washington: 1877. 8 vo., pp. 124.
- Do. ————. Miscellaneous publications, No. 10. Bibliography of North American Palæontology. By C. A. White, M. D., and H. A. Nicholson. Washington: 1878. 8 vo., pp. 132.
- Do. ————. Preliminary Report of the Field Work of the U. S. Geological and Geographical Survey of the Territories, for the Season of 1867, under direction of Prof. F. V. Hayden. Washington: 1877. Pamph., 8 vo., pp. 35.
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## REPORT OF THE BOTANIST.

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S. B. WOOLWORTH, LL. D., *Secretary of the Board of Regents of the University* :

SIR — Since the date of my last report, specimens of two hundred and thirteen species of plants have been mounted and placed in the Herbarium, of which one hundred and forty-six were not before represented therein. A list of these is marked (1).

Specimens have been collected in the counties of Albany, Hamilton, Montgomery, Onondaga, Oswego, Rensselaer, Saratoga, Schoharie and Ulster. These represent *one hundred and sixty-six species* new to the Herbarium, one hundred and sixty-two of which are fungi. Of these seventy-five are regarded as new or previously undescribed species. A list of plants collected is marked (2).

Specimens of fourteen New York species, new to the Herbarium, and not among my collections of the past season, have been furnished by correspondents. These, added to those collected, make the whole number of additions *one hundred and eighty*. There are, besides, a considerable number of extra-limital contributions. A list of the contributors and their contributions is marked (3).

New species, with their descriptions, and previously unreported species, are given in a section marked (4).

New stations of rare plants, remarks and observations are given in a section marked (5).

The general fruitfulness of the past season extended to the domain of fungi. Toward the end of summer the frequent showers and warm weather brought out these lowly plants in great abundance. In some localities species of *Lycoperdon*, commonly known as "Puff-balls," were very plentiful. One correspondent, in speaking of the Engraved puff-ball, *L. cælatum*, and the Cup-shaped puff-ball, *L. cyathiforme*, says: "Of these we have freely eaten for several weeks. They are most excellent. Within the limits of our town more than a ton of them rotted on the ground." The number of species of puff-balls now known to inhabit our State is sixteen. The published descriptions of these are scattered and not always accessible. In some instances the descriptions are very imperfect and unsatisfactory, and technical terms are employed in them, which, without explanation, are scarcely intelligible to persons unaccustomed to the language of scientific description. These facts, together with the importance of these fungi as an article of food, and the desirability of bringing them more into public notice and of enabling people generally to recognize the species, if they wish, have induced me to prepare a monograph of our New York species, in which the descriptions have been rewritten and the more technical terms fully explained. Copious remarks have been added to the descriptions, and the principal distinctive features of the species have been specially mentioned. The monograph on the genus *Lycoperdon* is marked (6). By its aid, it is thought, that any person, whether botanist or not, will be able to identify our species.

Specimens of puff-balls, when sliced and pressed, as they sometimes are, and mounted on herbarium sheets in the usual manner, lose much of their natural beauty and often have their distinctive specific characters impaired. I have,

therefore, collected and preserved a series of specimens in paper boxes. By this method of preservation the natural colors, shape and other characters are all retained as well as it is possible to preserve them in the dried state. With such specimens for study and comparison, clear ideas of the specific characters can be obtained, and all difficulty in the identification of the species is avoided.

## (1.)

## PLANTS MOUNTED.

*Not new to the Herbarium.*

*Thalictrum purpurascens* L.  
*Spergularia rub.* v. *campestris* Gr.  
*Rhus aromatica* Ait.  
*R.* *typhina* L.  
*Medicago lupulina* L.  
*Amphicarpæa monoica* Nutt.  
*Gleditschia triacanthus* L.  
*Robinia Pseudacacia* L.  
*Potentilla recta* L.  
*Crataegus tomentosa* L.  
*Ribes prostratum* L'Her.  
*Penthorum sedoides* L.  
*Sanícula Marilandica* L.  
*Pastinaca sativa* L.  
*Aster cordifolius* L.  
*Xanthium spinosum* L.  
*Arctostaphylos Uva-ursi* Spreng.  
*Vaccinium corymbosum* L.  
*Utricularia gibba* L.  
*Verbenâ braacteosa* Mx.  
*Lithospermum arvense* L.  
*Fraxinus pubescens* Lam.  
*Montelia tamariscina* Nutt.  
*Polygonum Hydropiper* L.  
*Ulmus Americana* L.  
*U.* *fulva* Mx.  
*Ostrya Virginica* Willd.  
*Alnus viridis* DC.  
*A.* *serrulata* Ait.  
*A.* *incana* Willd.  
*Betula populifolia* Ait.  
*Arisæma triphyllum* Torr.  
*A.* *Dracontium* L.  
*Lemna minor* L.

*Lemna perpusilla* Torr.  
*Potamogeton Oakesianus* Robbins.  
*Sagittaria het.* v. *angustifolia*.  
*Habenaria leucophæa* Gr.  
*Trillium erythrocarpum* Mx.  
*T.* *erectum* L.  
*Lilium Canadense* L.  
*Scirpus Eri.* v. *cyperinus* Gr.  
*Eleocharis palustris* R. Br.  
*E.* *melanocarpa* Torr.  
*Carex str.* v. *aperta* Gr.  
*Triticum caninum* L.  
*Poa trivialis* L.  
*Glyceria aquatica* Sm.  
*G.* *Canadensis* Trin.  
*Calamagrostis Pickeringii* Gr.  
*Poa laxa* Hænke.  
*P.* *alsodes* Gr.  
*P.* *compressa* L.  
*Brachyelytrum aristatum* Bv.  
*Dicksonia punctilobula* Kze.  
*Polypodium vulgare* L.  
*Aspidium spinulosum* Sw.  
*A.* *acrostichoides* Sw.  
*A.* *crist.* v. *Clintonianum*.  
*Cystopteris fragilis* Bernh.  
*Onoclea sens.* v. *obtusilobata*.  
*Scolopendrium vulgare* Sm.  
*Asplenium Rutamuraria* L.  
*Botrychium Lunaria* Sw.  
*B.* *simplex* Hitch.  
*B.* *lanceolatum* Angst.  
*B.* *Virg.* v. *gracile*.

*New to the Herbarium.*

*Solidago humilis* Pursh.  
*Utricularia subulata* L.  
*Salix purpurea* L.  
*Pinus mitis* Mx.  
*Potamogeton louchitis* Tuckm.

*Muscari racemosum* L.  
*Pogonia affinis* Aust.  
*Eleocharis tricostata* Torr.  
*Hypnum rusciforme* Weis.  
*Calicium curtum* T. & B.



- Calicium brunneolum* Ach.  
*Arthonia polymorpha* Ach.  
*Graphis eulectra* Tuckerm.  
*Sirosiphon tomentosum* Kutz.  
*Chlorostylium cataractarum* Kutz.  
*Agaricus cristatellus* Pk.  
   *A. fumescens* Pk.  
   *A. pinophilus* Pk.  
   *A. rubromarginatus* Fr.  
   *A. radicatellus* Pk.  
   *A. chrysophyllus* Fr.  
   *A. abscondens* Pk.  
   *A. septicus* Fr.  
   *A. albogriseus* Pk.  
   *A. micropus* Pk.  
   *A. undulatellus* Pk.  
   *A. rhodocalyx* Lasch.  
   *A. vermifluus* Pk.  
   *A. limonellus* Pk.  
   *A. squarrosoides* Pk.  
   *A. mycenoides* Fr.  
   *A. paludinellus* Pk.  
   *A. lentiformis* Pk.  
   *A. hymenocephalus* Pk.  
   *A. camptopus* Pk.  
*Coprinus rotundosporus* Pk.  
   *C. macrosporus* Pk.  
*Cortinarius Copakensis* Pk.  
   *C. lapidophilus* Lk.  
*Marasmius calopus* Fr.  
*Boletus Satanus* Lenz.  
*Polyporus pallidus* Schultz.  
   *P. induratus* Pk.  
   *P. subienlosus* Pk.  
   *P. semitinctus* Pk.  
*Hydnum sulphurellum* Pk.  
*Mucronella calva* A. & S.  
   *M. aggregata* Fr.  
*Solenia villosa* Fr.  
*Craterellus dubius* Pk.  
*Cyphella sulphurea* Batsch.  
*Stereum sanguinolentum* A. & S.  
*Clavaria fumigata* Pk.  
   *C. corynoides* Pk.  
*Tremella lutescens* Pers.  
*Guepinia Peziza* Tul.  
*Hymenula olivacea* Pk.  
*Physarum inaequalis* Pk.  
   *P. ornatum* Pk.  
   *P. atrorubrum* Pk.  
   *P. psittacinum* Dittm.  
*Badhamia affinis* Rost.  
*Didymium eximium* Pk.  
   *D. angulatum* Pk.  
*Chondrioderma difforme* Pers.  
*Diachæa subsessilis* Pk.  
*Comatricha Friesiana* De By.  
   *C. pulchella* Bab.  
*Lamproderma violaceum* Fr.  
*Areyria pomiformis* Rost.  
*Oligonema brevifila* Pk.  
*Trichia inconspicua* Rost.  
*Lycogala flavofusca* Ehrh.  
*Sacidium Pini* Fr.  
*Septoria Verbascicola* B. & C.  
   *S. Waldsteiniae* P. & C.  
*Phyllosticta Lonicerae* Desm.  
*Vermicularia trichella* Grev.  
   *V. albomaculata* Schw.  
*Melanconium Americanum* P. & C.  
*Sporidesmium sicinum* Thum.  
*Phragmidium bulbosum* Schl.  
*Uromyces polymorphus* P. & C.  
   *U. Trifolii* Eckl.  
*Ustilago Salvei* B. & Br.  
*Massospora cicadina* Pk.  
*Isaria limonipes* Pk.  
*Stilbum flavipes* Pk.  
   *S. rigidum* Pers.  
*Sporocybe abietina* Pk.  
*Helminthosporium Hydropiperis* Thum.  
   *H. interseminatum* B. & C.  
*Cladosporium Graminum* Lk.  
*Botryosporium pulchrum* Berk.  
*Polyactis vulgaris* Lk.  
*Aspergillus flavus* Lk.  
*Peronospora pygmaea* Ung.  
*Peronospora simplex* Pk.  
*Mucor ramosus* Bull.  
   *M. caninus* Pers.  
*Peziza Acetabulum* L.  
   *P. succosa* Berk.  
   *P. vulcanalis* Pk.  
   *P. gallinacea* Pk.  
   *P. sulphurea* Pers.  
   *P. viridicoma* Pk.  
   *P. Osmundæ* C. & E.  
   *P. umbrorum* Eckl.  
   *P. planodiscus* P. & C.  
   *P. brunneola* Desm.  
*Helotium albopunctum* Pk.  
   *H. phyllophilum* Pk.  
*Hæmatomyces orbicularis* Pk.  
*Patellaria olivacea* Batsch.  
*Dermatea carnea* C. & E.  
   *D. phyllophila* Pk.  
   *D. Xanthoxyli* Pk.  
*Tympanis acerina* Pk.

Cenangium *Cassandrae* *Pk.*  
*C. pezizoides* *Pk.*  
*Rhytisma maximum* *Fr.*  
*Phacidium brunneolum* *Pk.*  
*Hysterium hyalospermum* *Ger.*  
*Triblidium morbidum* *Pk.*  
*Hypoderma Corni* *Fr.*  
*H. nervisequum* *DC.*  
*Hypocrea viridis* *Tode.*  
*Hypoxyton xanthocreas* *B. & C.*  
*Diatrype asterostoma* *B. & C.*  
*Dothidea Epilobii* *Fr.*  
*Valsa Xanthoxyli* *Pk.*  
*V. translucens* *De Not.*

*Massaria gigaspora* *Desm.*  
*Lophiostoma prominens* *Pk.*  
*L. scelestia* *C. & E.*  
*Sphaeria pulchriseta* *Pk.*  
*S. curvicolla* *Pk.*  
*S. sorghophila* *Pk.*  
*S. fimiseda* *C. & D.*  
*S. phellogena* *B. & C.*  
*S. eladosporiosa* *Schw.*  
*S. Marciensis* *Pk.*  
*S. Crepini* *West.*  
*S. Typhae* *Schw.*  
*S. Guomon* *Tode.*  
*Venturia Dickiei* *De Not.*

(2.)

## PLANTS COLLECTED.

*Plantago Rugelii* *Dcaisne.*  
*Zygnema insigne* *Hussal.*  
*Chantransia violacea* *Ktz.*  
*Glaeotrichia Pisum* *Thuret.*  
*Agaricus spretus* *Pk.*  
*A. impolitoides* *Pk.*  
*A. alboides* *Pk.*  
*A. patuloides* *Pk.*  
*A. subhirtus* *Pk.*  
*A. dealbatus* *Sow.*  
*A. leptolomus* *Pk.*  
*A. odoratus* *Bull.*  
*A. anisarius* *Pk.*  
*A. hygrophoroides* *Pk.*  
*A. lentinoides* *Pk.*  
*A. atratoides* *Pk.*  
*A. cremoraceus* *Pk.*  
*A. luteopallens* *Pk.*  
*A. Epichysium* *Pers.*  
*A. tomentosulus* *Pk.*  
*A. umbrosus* *Pers.*  
*A. dysthales* *Pk.*  
*A. muricatus* *Fr.*  
*A. carbonarius* *Fr.*  
*A. sapineus* *Fr.*  
*A. aquatilis* *Fr.*  
*A. eutheloides* *Pk.*  
*A. nodulosporus* *Pk.*  
*A. infelix* *Pk.*  
*A. trechisporus* *Berk.*  
*A. Artemisiae* *Pass.*  
*A. modestus* *Pk.*

*Cortinarius iodes* *B. & C.*  
*C. caeruleus* *Fr.*  
*C. amarus* *Pk.*  
*C. crystallinus* *Fr.*  
*C. opimus* *Fr.*  
*C. furfurellus* *Pk.*  
*C. bivelus* *Fr.*  
*C. armeniacus* *Fr.*  
*Lactarius pubescens* *Fr.*  
*L. corrugis* *Pk.*  
*Russula nigricans* *Fr.*  
*R. compacta* *Frost.*  
*R. delicata* *Fr.*  
*R. olivascens* *Fr.*  
*R. flavida* *Frost.*  
*Hygrophorus lividoalbus* *Fr.*  
*Marasmius archyropus* *Pers.*  
*Boletus punctipes* *Pk.*  
*B. sensibilis* *Pk.*  
*B. Roxanae* *Frost.*  
*B. rubinellus* *Pk.*  
*Polyporus circinatus* *Fr.*  
*P. parvulus* *Klotzsch.*  
*P. simillimus* *Pk.*  
*P. Morgani* *Frost.*  
*P. cuticularis* *Bull.*  
*P. chrysoloma* *Fr.*  
*P. molluscus* *Fr.*  
*Trametes Trogii* *Berk.*  
*Hydnum alutaceum* *Fr.*  
*Craterellus Cantharellus* *Schw.*  
*C. clavatus* *Fr.*

*Corticium subrepandum* B. & Ck.  
*Thelephora radiata* Holmsk.  
*Clavaria formosa* Pers.  
*C. fastigiata* L.  
*C. corrugata* Karst.  
*C. flaccida* Fr.  
*Pterula divaricata* Pk.  
*Tremella subcarnosa* Pk.  
*Dacrymyces conglobatus* Pk.  
*Phallus Ravenelii* B. & C.  
*Geaster Capensis* Thum.  
*Melanogaster variegatus* Tul.  
*Rhizopogon rubescens* Tul.  
*Enerthenema papillata* Pers.  
*Cribraria vulgaris* Schrad.  
*Depazea juglandina* Fr.  
*Vermicularia compacta* C. & E.  
*Septoria Populi* Desm.  
*S. Canadensis* Pk.  
*Sphaeropsis cornina* Pk.  
*S. typhina* Pk.  
*S. Peckiana* Thum.  
*Synchytrium Anemones* DC.  
*Protonyces conglomeratus* Pk.  
*Puccinia Scirpi* Lk.  
*Torula anomala* Pk.  
*Acrospermum album* Pk.  
*Isaria fulvipes* Pk.  
*Tubercularia hirtissima* Pk.  
*T. floccosa* Lk.  
*Periconia albiceps* Pk.  
*Septosporium velutinum* C. & E.  
*Helminthosporium obovatum* Berk.  
*Cladosporium compactum* B. & C.  
*Heterosporium Ornithogali* Kl.  
*Fusieladium dendriticum* Wallr.  
*Polyactis cinerea* Berk.  
*Oidium destruens* Pk.  
*Ramularia effusa* Pk.  
*R. albomaculata* Pk.  
*R. lineola* Pk.  
*R. Fragariæ* Pk.  
*R. Norvegicæ* Pk.  
*R. Plantaginis* Pk.  
*R. variabilis* Fckl.  
*R. angustata* Pk.  
*Cercospora Rosæcola* Pass.  
*C. Apii* Fres.  
*Glomerularia Corni* Pk.  
*Peronospora Ficariæ* De By.  
*P. Corydalis* De By.

*Peronospora gangliiformis* Berk.  
*Sporotrichum larvatum* Pk.  
*S. sulphureum* Grer.  
*S. alutaceum* Schw.  
*Spondylocadium tenellum* Pk.  
*Penicillium bicolor* Fr.  
*Acremonium flexuosum* Pk.  
*Sepedonium cervinum* Dittm.  
*S. brunneum* Pk.  
*Morchella angusticeps* Pk.  
*Gyromitra curtipes* Fr.  
*Geoglossum irregulare* Pk.  
*Peziza euplecta* Ck.  
*P. melastoma* Sow.  
*P. apiculata* Ck.  
*P. tetraönalis* Pk.  
*P. humosoides* Pk.  
*P. longipila* Pk.  
*P. aurata* Fckl.  
*P. melaleuca* Fr.  
*P. urticina* Pk.  
*P. Typhæ* Pk.  
*P. enterochroma* Pk.  
*Helotium palustre* Pk.  
*H. fraternum* Pk.  
*H. lutescens* Fr.  
*H. vibrisseoides* Pk.  
*Dermatea minuta* Pk.  
*Patellaria pusilla* Pk.  
*Bulgaria bicolor* Pk.  
*B. deligata* Pk.  
*Hypomyces luteovirens* Fr.  
*Exoascus Pruni* Fckl.  
*Taphrina aurea* Fr.  
*Hypoxyton udum* Fr.  
*Dothidea reticulata* Fr.  
*Diatrype verrucoides* Pk.  
*Valsa pulviniceps* Pk.  
*V. Sorbi* Fr.  
*Lophiostoma bicuspidata* Ck.  
*Sphæria squamulata* Schw.  
*S. albidostoma* Pk.  
*S. subieulata* Schw.  
*S. intricata* Pk.  
*S. scopula* C. & P.  
*S. subdenudata* Pk.  
*S. livida* Fr.  
*S. humulina* Pk.  
*S. elavarilna* Pk.  
*Sphærella Peckii* Spegaz.  
*S. septorioides* Pk.

(3.)

## CONTRIBUTORS AND THEIR CONTRIBUTIONS.

Rev. H. WIBBE, Oswego, N. Y.

*Listera australis* *Link.* | *Botrychium simplex* *Hitch.*

Prof. P. A. PUISSANT, Troy, N. Y.

*Solidago Virgaurea* *L.* |

ADDISON BROWN, New York City, N. Y.

<i>Lepidium Draba</i> <i>L.</i>	<i>Asperugo procumbens</i> <i>L.</i>
<i>L. ruderales</i> <i>L.</i>	<i>Matricaria Chamomilla</i> <i>L.</i>
<i>Thlaspi arvense</i> <i>L.</i>	<i>Aster memorialis</i> <i>Ait.</i>
<i>Alliaria officinalis</i> <i>DC.</i>	

E. S. MILLER, Wading River, N. Y.

*Glaucium luteum* *Scop.* | *Hypericum adpressum* *Barton.*

N. L. BRITTON, New Dorp, N. Y.

*Pinus mitis* *Mr.* | *Pinus inops* *Ait.*

H. A. WARNE, Oneida, N. Y.

*Cynophallus caninus* *Fr.* |

L. M. UNDERWOOD, Syracuse, N. Y.

*Zygadenus glaucus* *Nutt.* |

Hon. G. W. CLINTON, Buffalo, N. Y.

<i>Aster Novæ-Angliæ</i> <i>L.</i>	<i>Verticillium lateritium</i> <i>Ehr.</i>
<i>A. ericoides</i> <i>L.</i>	<i>Sporotrichum virescens</i> <i>Lk.</i>
<i>Gentiana puberula</i> <i>Mr.</i>	<i>Peziza Sphærella</i> <i>P. &amp; C.</i>
<i>Hydnum cinnabarinum</i> <i>Schw.</i>	<i>Helotium Sarmentorum</i> <i>Fr.</i>
<i>H. fuscoâtrum</i> <i>Fr.</i>	<i>Sphæria pulviscula</i> <i>Curr.</i>
<i>Clathrus cancellatus</i> <i>L.</i>	<i>S. infectoria</i> <i>Fckl.</i>
<i>Sphæropsis pulchrispora</i> <i>P. &amp; C.</i>	<i>Grandinia membranacea</i> <i>P. &amp; C.</i>
<i>Tubercularia subdiaphana</i> <i>Schw.</i>	

W. DOOLITTLE, Medusa, N. Y.

*Lycoperdon giganteum* *Batsch.* |

S. H. WRIGHT, M. D., Penn Yan, N. Y.

<i>Potamogeton crispus</i> <i>L.</i>	<i>Ulmus racemosa</i> <i>Thomas.</i>
<i>Desmodium nudiflorum</i> <i>DC.</i>	<i>Polygonum amphibium</i> <i>L.</i>
<i>Aster puniceus</i> <i>L.</i>	<i>P. Hartwrightii</i> <i>Gr.</i>

A. P. MORGAN, Dayton, Ohio.

*Agaricus Morgani* *Pk.* | *Polyporus Morgani* *Frost.*

Prof. A. M. JOHNSON, Minneapolis, Minn.

Polyporus tomentosus-quercinus *Johns.* |

H. W. RAVENAL, Aiken, S. C.

Lentinus Lecomtei *Fr.*Phallus rubicundus *Bosc.*Lycoperdon leprosum *B. & Rav.*

C. F. AUSTIN, Closter, N. J.

Micromitrium Austinii *Sulliv.*Agaricus chlorinosmus *Pk.*

M. S. BEBB, Fountaindale, Ill.

Salix petiolaris *Smith.* |

W. C. STEVENSON, JR., Philadelphia, Pa.

Trametes suaveolens *Fr.*Polyporus cuticularis *Fr.*

W. F. BUNDY, Sauk City, Wis.

Podaxon Warnei *Pk.* |

Prof. W. G. FARLOW, Cambridge, Mass.

Synchytrium Myo. v. Potentillæ.

S. papillatum *Far.*Peronospora Ficariæ *Tul.*P. obducens *Schroet.*P. Potentillæ *De By.*P. nivea *Ung.*Ramularia macrospora *Fres.*Cenangium pythium *B. & C.*Podisoma Ellisii *Berk.*Uromyces Junci *Schw.*U. Dactylidis *Oth.*

Puccinia Epil. v. Proserpinaceæ.

Taphrina aurea *Fr.*T. alnitorqua *Tul.*Ascomyces deformans *Berk.*Dothidea vorax *B. & C.*

E. A. RAU, Bethlehem, Pa.

Puccinia Grindeliæ *Pk.*P. Kulniæ *Schw.*P. cladophila *Pk.*Accidium gracilens *Pk.*Uromyces sanguineus *Pk.*U. Brandegei *Pk.*U. simulans *Pk.*U. plumbarius *Pk.*

J. B. ELLIS, Newfield, N. J.

Trametes suaveolens *Fr.*Polyporus volvatus *Pk.*Uromyces Junci *Schw.*Helicosporium olivaceum *Pk.*H. ellipticum *Pk.*H. lilacinum *Ellis.*Diplodia ilicicola *Desm.*Vermicularia compacta *C. & E.*Hymenula æruginosa *C. & E.*Corticium subrepandum *B. & Cke.*Septosporium prælongum *Sacc.*Cercospora grisea *C. & E.*Polyactis streptothrix *C. & E.*Chætostroma olivaceum *C. & E.*Peziza fuscidula *C. & E.*P. regalis *C. & E.*P. pulverulenta *Lib.*P. atrocinerea *Ck.*P. Pinastri *C. & P.*Meliola amphitricha *Fr.*Lophiostoma cyclopeum *Ellis.*Sphæria barbirostris *Duf.*S. Eriophora *Ck.*S. soluta *C. & E.*S. distributa *C. & E.*S. Desmodii *Pk.*S. Ogilviensis *B. & Br.*

(4.)

## PLANTS NOT BEFORE REPORTED.

GLAUCIUM LUTEUM *Scop.*Shore of Fort Pond Bay, Montauk Point. *E. S. Miller.*ALLIARIA OFFICINALE *DC.*Hunter's Point, Westchester County. *Addison Brown.*HYPERICUM ADPRESSUM *Bart.*Between Sag Harbor and East Hampton. *Miller.*ASTER NEMORALIS *Ait.*Long island and Hitchings Pond, Adirondack Mountains. *Brown.*PLANTAGO RUGELII *Decaisne.*Not uncommon about Albany, but often confused with *Plantago major.*GENTIANA PUBERULA *Me.*Buffalo *G. W. Clinton.*POTAMOGETON CRISPUS *L.*Keuka Lake, Yates County. *S. H. Wright.*CHANTRANSIA VIOLACEA *Ktz.*

Wet rocks in rapid streams. Sprakers. June.

This alga forms soft mats or cushions of a dark-red or purplish color on rocks kept wet by rapidly flowing water.

ZYGNEA INSIGNE *Hassel.*

Standing water in ditches. North Greenbush. June.

GLÆOTRICHIA PISUM *Thuret.*

Floating and submerged leaves of water plants. Brewerton. Sept.

MICROMITRIUM AUSTINII *Sulliv.*Ground. Rockland County. *C. F. Austin.*AGARICUS (AMANITA) SPRETUS *n. sp.*

Pileus subovate, then convex or expanded, smooth or adorned with a few fragments of the volva, substriate on the margin, whitish or pale-brown; lamellæ close, reaching the stem, white; stem equal, smooth, annulate, stuffed or hollow, whitish, finely striate at the top from the decurrent lines of the lamellæ, not bulbous at the base, but the volva rather large, loose, subochreate; spores elliptical, generally with a single large nucleus, .0004 - .0005' long, .00025'-.0003' broad.

Plant 4-6' high, pileus 3-5' broad, stem 4"-6' thick.

Ground in open places. Sandlake and Gansevoort. Aug.

This species belongs to the Phalloidean section, and is related to *A. porphyrius* and *A. recentitus*. The margin of the pileus is generally clearly, though sometimes obsoletely, striate. The absence of a bulbous base separates it from *A. mappa*.

AGARICUS (TRICHOLOMA) IMPOLITOIDES *n. sp.*

Pileus convex, then expanded, obtuse, dry, fibrillose-tomentose, becoming squamose on the disk, sometimes distantly striate on the margin, whitish, the disk usually brownish; lamellæ close, emarginate, whitish; stem equal, solid, slightly fibrillose, white; spores elliptical, .00025 long, .0002' broad; flesh white, taste farinaceous.

Plant 3'-4' high, pileus 2'-3' broad, stem 3''-5'' thick.

Ground in woods. Gansevoort. Aug.

This plant is closely related to *A. impolitus*, but I do not find the stem squamose nor the taste salty or peppery as in that species. It sometimes grows in circles. The scaly disk at first sight is suggestive of species of *Lepiota*.

AGARICUS (TRICHOLOMA) ALBOIDES *n. sp.*

Pileus compact, firm, convex, glabrous, white, the disk tinged with yellow or brown; lamellæ crowded, rounded behind, subfree, white; stem nearly equal, solid, firm, squamulose at the apex, white; spores subelliptical, .0002'-.00025' long, .00016' broad; taste at first bitter, then very acrid, odor strong, earthy or subfetid.

Plant 3'-4' high, pileus 2-3' broad, stem 3'-6' thick.

Ground in woods. Brewerton. Sept.

This species is very near to *A. albus*, but its compact pileus, peppery taste and strong odor seem to require its separation. The stem sometimes penetrates the earth quite deeply.

AGARICUS (CLITOCYBE) SUBHIRTUS *n. sp.*

Pileus convex or expanded, sometimes slightly depressed, at first tomentose-hairy and pale-yellow or buff colored, then nearly glabrous and whitish, the margin incurved; lamellæ close, adnate or decurrent, whitish or pale yellow; stem subequal, stuffed or hollow, whitish; spores subglobose, or broadly elliptical, .00025' long.

Plant 1'-3' high, pileus 1'-3' broad, stem 2'-4'' thick.

Ground in woods. Brewerton. Sept.

The species is apparently related to *A. subalutaceus*. The pileus becomes smoother and paler with age. The spores sometimes present an irregular form.

AGARICUS (CLITOCYBE) PATULOIDES *n. sp.*

Pileus compact, convex or expanded, glabrous, the cuticle sometimes breaking up into small appressed scales, whitish or pale-yellow, the margin incurved; lamellæ thin, crowded, decurrent and reticulately connected in thin lines; stem equal, solid, firm, glabrous, whitish; spores subglobose or broadly elliptical, .00025-.0003' long; flesh pure white.

Plant gregarious or circinating, 2-4' high, pileus 1'-4' broad, stem 4''-10'' thick.

In groves and open woods. Brewerton. Sept.

The reticulations of the narrowly decurrent lamellæ at the top of the stem indicate a relationship with *A. patulus*, but it appears to be a *Clitocybe*, not a *Tricholoma*, and therefore must be distinct.

AGARICUS DEALBATUS *Sow.*

Grassy pastures. Brewerton. Sept.

AGARICUS ODORUS *Bull.*

Ground in woods. Gansevoort. Aug.

In our specimens the lamellæ are close and white, and the pileus loses its green color with age.

AGARICUS (CLITOCYBE) ANISARIUS *n. sp.*

Pileus convex, then expanded, greenish-gray with the margin incurved, then grayish or whitish, adorned with minute innate fibrils, slightly pruinose and substriate on the margin; lamellæ adnate or decurrent, narrow, crowded, white; stem subequal, firm, hollow, whitish; spores subelliptical, .00025' long; odor weak but pleasant, anise-like.

Plant 2'-4' high, pileus 1.5'-3' broad, stem 2'-3' thick.

Ground in woods. Gansevoort. Aug.

This is closely related to *A. connexus*, from which it is easily separated by the hollow stem.

AGARICUS (CLITOCYBE) LEPTOLOMUS *n. sp.*

Pileus thin, plane or infundibuliform, umbilicate, hygrophanous, smooth, creamy-white when moist, white when dry, the margin very thin; lamellæ thin, narrow, crowded, some of them forked, decurrent, white; stem equal, smooth, generally curved or flexuous, stuffed, colored like the pileus, white-villous at the base; spores very minute, subelliptical, .00012' long.

Plant gregarious or subcaespitose 2'-3' high, pileus about 2' broad, stem 1'-2' thick.

Decaying prostrate trunks in woods. Indian Lake. Aug.

The width of the lamellæ is about equal to the thickness of the flesh of the pileus. They taper gradually toward each end, where they are very narrow. The species may be distinguished from *A. truncicola* by its hygrophanous umbilicate pileus. The stem is sometimes eccentric.

AGARICUS (COLLYBIA) CREMORACEUS *n. sp.*

Pileus thin, submembranaceous, convex or campanulate, obtuse, dry, slightly silky, dingy cream color, the margin sometimes wavy; lamellæ broad, ascending, ventricose, with a decurrent tooth, whitish; stem slender, slightly silky, stuffed or hollow, pallid or subconcolorous; spores broadly elliptical or subglobose, .00025' long, .0002' broad.

Plant 1.5'-2' high, pileus 6"-12" broad, stem about 1' thick.

Ground in woods. Gansevoort. Aug.

AGARICUS (COLLYBIA) HYGROPHOROIDES *n. sp.* (Plate II, figs. 21-24.)

Pileus subconical, then convex or expanded, smooth, hygrophanous, reddish or yellowish-red when moist, paler when dry; lamellæ sub-distant, rounded behind or deeply emarginate, eroded on the edge, whitish; stem nearly equal, striate, stuffed or hollow, whitish; spores subelliptical, .0002'-00025' long, .00016' broad.



Plant subcaespitose, 2'-3' high, pileus 1'-1.5' broad, stem 2''-3'' thick.

Decaying half-buried wood. Knowersville. May.

At first sight the young pileus is suggestive of the pileus of *Hygrophorus conicus*, both in shape and color. When dry the color is pallid or subochraceous.

**AGARICUS (COLLYBIA) LENTINOIDES** *n. sp.*

Pileus thin, convex, obtuse, smooth, hygrophanous, reddish-brown or chestnut color when moist, reddish-alutaceous when dry; lamellæ narrow, close, adnexed, serrate on the edge, white; stem equal, substriate, slightly pruinose at the apex, white.

Plant about 2' high, pileus 6''-10'' broad, stem 1'' thick.

Ground in wooded swamps. Root, Montgomery County. June.

The serrated lamellæ and white substriated stem will serve to distinguish this species from *A. dryophilus*.

**AGARICUS (COLLYBIA) ATRATOIDES** *n. sp.*

Pileus thin, convex, subumbilicate, glabrous, hygrophanous, blackish-brown when moist, grayish-brown and shining when dry; lamellæ rather broad, adnate, subdistant, grayish-white, often venulose-connected and transversely marked above with slender veins; stem equal, hollow, smooth, grayish-brown, with a whitish tomentum at the base; spores nearly globose, about .0002' across.

Plant gregarious or subcaespitose, about 1' high, pileus 6''-10'' broad, stem .5''-1'' thick.

Decaying mossy sticks and logs in woods. Gansevoort. Aug.

The species belongs to the section *Tephrophanae*, and is apparently related to *A. atratus*.

**AGARICUS (MYCENA) LUTEOPALLENS** *n. sp.*

Pileus thin, convex, smooth, striatulate on the margin when moist, bright yellow, becoming paler when dry; lamellæ moderately close, subarcuate, yellow; stem equal or slightly tapering upward, smooth, hollow, yellow, with yellow hairs and fibrils at the base.

Plant single or caespitose, 2' high, pileus 3''-6'' broad, stem about 1'' thick.

Among fallen leaves in woods. Adirondack Mountains. Aug.

This species may be distinguished from *Hygrophorus parvulus* by its subcaespitose habit, and the yellow hairs at the base of the stem.

**AGARICUS EPICHYSIUM** *Pers.*

Decaying prostrate trunks of trees. Indian Lake. Aug.

**AGARICUS (PLUTEUS) TOMENTOSULUS** *n. sp.*

Pileus thin, convex or expanded, subumbonate, dry, minutely squamulose-tomentose, white, sometimes pinkish on the margin; lamellæ rather broad, rounded behind, free, crowded, white, then flesh-colored; stem equal, solid, striate, slightly pubescent or subtomentose, white; spores subglobose, .0003' in diameter, generally containing a single large nucleus.

Plant 2'-5' high, pileus 1-3' broad, stem 2"-4" thick.

Decaying wood. Catskill Mountains and Gansevoort. July and August.

AGARICUS UMBROSUS *Pers.*

Decaying wood. Indian Lake. Aug.

AGARICUS (ENTOLOMA) DYSTHALES *n. sp.*

Pileus submembranaceous, subconical, then convex or expanded, obtuse, striate, furfuraceous or squamulose, lurid-brown, becoming paler with age; lamellæ broad, subdistant, ventricose, brown or grayish-brown, then flesh-colored; stem equal, hollow, slender, tomentose-squamulose, brownish; spores irregularly oblong-elliptical, .0006'-.00065' long, about half as broad, usually containing a single large nucleus.

Plant about 2' high, pileus 3'-6" broad, stem about 1" thick.

Damp ground in woods. Catskill Mountains. July.

The species belongs to the section Leptonidei. It has a peculiar starved deformed appearance, whence the specific name. To the naked eye the pileus appears to be clothed with minute branny scales, but under a lens these are seen to be jointed matted filaments which form a kind of thin squamulose tomentum. In some specimens it is more dense than in others, both on the pileus and stem. The general outline of the spores is narrowly elliptical, but they are somewhat pointed at the base and they also have the angular projections, which are generally present on the spores of species of *Entoloma*. The adornment of the pileus and stem indicates an affinity with *A. jubatus*, but our plant is much smaller than that and is very different in its habit.

AGARICUS MURICATUS *Fr.*

Decaying wood of deciduous trees. Carlisle and Indian Lake. June and August.

AGARICUS TRECHISPORUS *Berk.*

Ground in woods. Brewerton. Sept.

Only a single specimen was found. The pileus is nearly white and the plant odorless, but in other respects it agrees well with the description of the species to which we have referred it.

AGARICUS (INOCYBE) NODULOSPORUS *n. sp.*

Pileus thin, hemispherical or convex, obtuse, floccose-squamose, dark cervine-brown or umber color, the scales of the disk usually erect; lamellæ rounded behind, adnexed, ventricose, pallid, then ferruginous-cinnamon, white and minutely toothed on the margin; stem equal, solid, tomentose-squamulose, colored like the pileus; spores rough, .0003'-.00035' long.

Plant about 1' high, pileus 4"-8" broad, stem scarcely 1" thick.

Decaying wood in woods. Gansevoort. Aug.

This species agrees very closely with the description of *A. lanuginosus*, to which I should have referred it but for the rough spores. It is smaller than *A. stellatosporus*, of a paler color and a more soft and woolly appearance. Both belong to the section Squarrosi.

AGARICUS (INOCYBE) EUTHELOIDES *n. sp.*

Pileus thin, conic or campanulate, then expanded, distinctly umbonate, silky-fibrillose, subrimose, varying in color from grayish-cervine to chestnut-brown, the disk sometimes squamulose; lamellæ moderately close, rather broad, ventricose, narrowed or rounded behind, adnexed, whitish, then ferruginous-brown, white and denticulate on the edge; stem equal, subflexuous, solid, whitish-fibrillose, pallid; spores even, uninucleate, gibbous or unequally elliptical, .00035'-.0004' long; flesh of the pileus white.

Plant 1-2' high, pileus 6'-12' broad, stem 1"-2" thick.

Ground in woods. Brewerton. Sept.

The species seems to be closely related to *A. eutheles*, from which it differs in the character of the lamellæ, which are rather abruptly and strongly narrowed behind, in the absence of a farinaceous odor and in the character of the spores. The stem is paler than the pileus, sometimes being nearly white. The species belongs to the section *Rimosi*.

AGARICUS (INOCYBE) INFELIX *n. sp.*

Pileus campanulate, convex or expanded, subumbonate, fibrillose-squamulose, grayish-brown or umber; lamellæ close, emarginate, ventricose, rather broad, whitish, then ferruginous-brown; stem equal, solid, pallid or whitish, sometimes darker toward the base, silky fibrillose, white and pruinose at the top; spores oblong, .0004'-0005' long, about .0002' broad; flesh of the pileus white, odor none.

Plant 1-2' high, pileus 6'-12" broad, stem 1'-2' thick.

Sterile mossy ground in open places. Indian Lake. Aug.

The species belongs to the section *Laceri*. In wet weather the pileus becomes more lacerated than in dry. It generally becomes paler with age. A small form occurs in which the pileus is scarcely umbonate and 4"-6" broad, with the stem about half an inch high. The oblong spores afford a ready character by which to separate this species from the preceding.

AGARICUS SAPINEUS *Fr.*

Decaying prostrate trunks. Brewerton. Sept.

AGARICUS CARBONARIUS *Fr.*

Burnt ground. Sandlake. May.

AGARICUS AQUATILIS *Fr.*

In wet moss along rivulets. Catskill Mountains. July.

AGARICUS FLAVIDUS *Schæff.*

Decaying wood. Indian Lake. Aug.

AGARICUS ARTEMISIÆ *Pass.*

Damp ground in woods. Brewerton. Sept.

AGARICUS (HYPHOLOMA) MODESTUS *n. sp.*

Pileus thin, convex or subconical, then expanded, rarely slightly umbonate, hygrophanous, reddish-brown or pale chestnut-colored when moist, dingy or

ochraceous-brown when dry, smooth, the margin whitened when young by the flocculent evanescent veil, sometimes striate; lamellæ plane, broad, adnate or slightly emarginate, usually with a decurrent tooth, grayish or clouded, becoming purplish-brown, the edge white; stem equal, rather firm, hollow, fibrillose, brownish; spores purple-brown, broadly ovate, compressed, .00025'-.0003' long.

Plant gregarious, about 1' high, pileus 4'-10" broad, stem about 1" thick.

Bark and branches lying on the ground in woods. Adirondack Mountains. Aug.

The species belongs to the section *Appendiculati*. In drying the disk changes its color first.

*CORTINARIUS CÆRULESCENS* Fr.

Ground in woods and groves. Brewerton. Sept.

Our specimens were violet rather than blue, but they were not very young and may have lost some of their original color.

*CORTINARIUS CRYSTALLINUS* Fr.

Mossy ground in low woods. Sandlake. Oct.

The specimens are much smaller than the dimensions given in the description, and the habitat is different, but they agree very well with the figures of the species.

*CORTINARIUS (PHLEGMACIUM) AMARUS* n. sp.

Pileus convex or expanded, often irregular, smooth, glutinous in wet weather, yellow, the disk sometimes tinged with red, pale-yellow when dry, the margin whitish; lamellæ close, rounded behind, whitish, then ochraceous-cinnamon; stem soft, tapering upward, solid, whitish, at first clothed with white silky fibrils; flesh white, taste very bitter.

Plant gregarious or subcaespitose, 1'-2' high, pileus about 1' broad, stem 2-4" thick.

Ground under spruce and balsam trees. Adirondack Mountains. Aug.

In wet weather the stem is sometimes viscid, apparently from the gluten of the pileus running down upon it.

*CORTINARIUS IODES* B. & C.

Ground in woods. Sandlake. Aug.

This is a small but beautiful species, the pileus, lamellæ and stem being of a bright-violet or purplish-violet hue. The spores are subelliptical, generally uninucleate, .0004' long, .00025' broad.

*CORTINARIUS OPIMUS* Fr.

Ground in woods. Catskill Mountains. July.

*CORTINARIUS BIVELUS* Fr.

In woods about the margin of swamps. Center. Sept.

The margin is often whitish with superficial fibrils which sometimes form a continuous zone and sometimes are collected in patches

*CORTINARIUS (TELAMONIA) FURFURELLUS n. sp.*

Pileus thin, convex, furfuraceous with minute squamules, hygrophanous, watery-tawny when moist, pale ochraceous when dry; lamellæ broad, thick, distant, adnate or slightly emarginate, tawny-yellow, then cinnamon; stem equal, peronate, colored like the pileus, with a slight annulus near the top; spores subelliptical, minutely rough, .0003–.0004' long, .00025' broad.

Plant 1'–2' high, pileus 1'–2' broad, stem 2''–4'' thick.

Moist ground in open places. Gansevoort. Aug.

*CORTINARIUS ARMENIACUS Fr.*

Ground in woods. Gansevoort. Aug.

*HYGROPHORUS LIVIDOALBUS Fr.*

Ground in woods. Brewerton. Sept.

*LACTARIUS PUBESCENS Fr.*

Ground in open woods. Sandlake and Gansevoort. Aug.

Our specimens have the margin of the pileus obsoletely pubescent, and generally narrowly zonate. The stem is white, and either equal or tapering downward; it is sometimes spotted, but I have not seen it with incarnate tints. In other respects they agree so well with the description of *L. pubescens*, that I have concluded to refer them to that species.

*LACTARIUS CORRUGIS n. sp.*

Pileus fleshy, compact, firm, convex, then expanded or centrally depressed, merulioid or corrugated with gyrose-reticulate wrinkles, dark reddish-brown or chestnut-colored, becoming paler with age, suffused as if with a slight pruinosity; lamellæ close, dark creamy-yellow or sub-cinnamon, becoming paler, often distilling drops of moisture, sordid or brownish where bruised; stem equal, solid, firm, paler than the pileus, sub-pruinose; spores large, sub-globose, .00045–.0005 in diameter, intermixed with small acicular points or spicules, .0016–.002 long; flesh whitish or cream-colored, milk copious, white, mild.

Plant 4–6' high, pileus 3'–5' broad, stem 6''–12'' thick.

Ground in woods. Sandlake, Gansevoort and Brewerton. August and September.

This remarkable species is related to *L. volvens*. It is, however, of a darker color, and the surface of the pileus is very uneven from the presence of rugæ or folds, which present an appearance much like that of the hymenium of some species of *Merulius*. The spicules of the lamellæ too are a peculiar feature. They are so numerous that under a lens they give a pubescent appearance to the edge of the lamellæ.

*RUSSULA NIGRICANS Bull.*

Ground in woods. Gansevoort and Brewerton. Aug. and Sept.

Our specimens agree with the description in every respect except that the lamellæ are not distant.

RUSSULA DELICA *Fr.*

Ground in woods. Center and Brewerton.

This very closely resembles *Lactarius vellereus*, from which it may be distinguished by its mild taste, and the absence of a milky juice. From the juiceless variety of *L. vellereus* its mild taste alone furnishes a separating character.

RUSSULA COMPACTA *Frost MS.*

Pileus fleshy, compact, convex, sometimes centrally depressed, dry, whitish, sometimes tinged or spotted with reddish or yellowish hues, becoming dingy or reddish alutaceous when old or dry, the margin thin but even; lamellæ broad, sub-distant, unequal, a few of them forked, nearly free, white, becoming brown when bruised or dried; stem equal, firm, rather short, solid, white, changing color like the pileus; spores subglobose, nearly smooth, .00035' in diameter; flesh whitish or subalutaceous, taste mild, odor when drying very disagreeable.

Plant 2-4' high, pileus 3'-5' broad, stem 8'-12" thick.

Ground in open woods. Sandlake and Brewerton. Aug. and Sept.

Our specimens do not fully agree with Mr. Frost's manuscript description, but they approach so near an agreement that we have not thought best to separate them. The pileus is sometimes split on the margin. The change of color in the pileus and stem is nearly the same, but the lamellæ become darker than either. The disagreeable odor is retained a long time by the dried specimens. The species belongs to the section Compactæ.

RUSSULA OLIVASCENS *Fr.*

Ground in woods. Gansevoort. Aug.

RUSSULA FLAVIDA *Frost MS.*

Pileus fleshy, convex, slightly depressed in the center, not polished, yellow, the margin at first even, then slightly striate-tuberculate; lamellæ nearly entire, venose-connected, white, then cinereous or yellowish; stem firm, solid, yellow, sometimes white at the top; spores yellow, subglobose, .00025'-.0003' in diameter; flesh white, taste mild.

Plant 2'-3' high, pileus 2'-3' broad, stem 4"-6" thick.

Ground in woods. Sandlake. Aug.

MARASMIUS ARCHYROPUS *Pers.*

Ground in woods and swamps. Albany, Adirondack Mountains, etc. This is one of our most common species. It was formerly confused with *M. velutipes*. The latter is generally smaller and has the pileus darker colored and usually with a slight umbilicus. The stem is more slender and its velvety covering inclining to a tawny or subochraceous hue. Both species occur in our State.

BOLETUS PUNCTIPES *n. sp.*

Pileus convex or expanded, glutinous in wet weather, yellow, the thin margin at first minutely grayish-pulverulent, at length recurved; tubes short, nearly plane, adnate, small, subrotund, at first brownish, then sordid-yellow;

stem firm, thickened at the base, glandular-dotted, exannulate, solid, rhubarb-yellow; spores .00035 - .0004 long, .00016' broad, flesh yellowish, inclining to grayish in the stem.

Plant 2'-4' high, pileus 2'-3' broad, stem 3'-5' thick.

Ground in woods. Gansevoort. Aug.

This species belongs to the section Viscipelles. It is related to such species as *B. albus*, *B. granulatus*, etc. Its rhubarb-colored stem thickened at the base and the brownish color of the young hymenium are its distinguishing features.

**BOLETUS RUBINELLUS** *n. sp.* (Plate II, figs. 18-20.)

Pileus at first broadly conical or subconvex, then expanded, subtomentose, red, becoming paler with age; tubes convex, adnate or somewhat depressed around the stem, rather large, subrotund, pinkish-red, then sordid-yellow; stem equal, smooth, yellow with reddish stains; spores oblong, .0005' - .0006' long, .00016' broad; flesh of both pileus and stem bright-yellow.

Plant about 2' high, pileus 1'-2' broad, stem 1'-2' thick.

Ground in woods. Gansevoort. Aug.

The species belongs to the section Subtomentosi, and is apparently related to *B. rubinus*.

**BOLETUS SENSIBILIS** *n. sp.*

Pileus at first firm, convex, pruinose-tomentose, brick-red, then expanded, paler or ochraceous-red, glabrous, soft; tubes at first plane or concave, bright-yellow, then tinged with green, finally sordid-yellow, small, subrotund; stem firm, smooth, lemon-yellow, narrowed at the top when young, and sometimes slightly cribrate from the decurrent walls of the tubes, often stained with red or rhubarb-color; spores greenish-brown, .0005' long, .00016' broad; flesh of the pileus pale-yellow, of the stem brighter colored and marbled, both flesh and tubes quickly changing to blue when wounded.

Plant scattered or caespitose, 4'-6' high, pileus 3'-8' broad, stem 6'-12'' thick.

Ground in woods. Gansevoort. Aug.

The species belongs to the section Subpruinosi. The specific name is suggested by the ease and rapidity with which the change of color is produced. Merely handling the specimens produces the blue color where they are pressed by the fingers. The species seems near *B. miniato-olivaceus*, but the difference in the color of the pileus and in the character of the stem and its susceptibility to change of color seem to require its separation.

**BOLETUS ROXANE** *Frost.*

Ground in woods. Sandlake. Aug.

The margin of the pileus in our specimens is conspicuously involute when young. The stem is sometimes yellow at the top. The species belongs to the section Edules.

**POLYPORUS PARVULUS** *Klotzsch (P. connatus Schw.).*

Burnt ground. Brewerton. Sept.

Either a closely related species or else a variety of this one sometimes occurs on shaded banks by roadsides. It has the large pores and spores of

*P. parvulus*, but the ferruginous or tawny color of *P. perennis*. I have seen only poor deformed specimens, and for the present prefer to consider it a variety of the above under the name *P. parvulus* var. *deformatus*.

#### POLYPORUS SIMILLIMUS *n. sp.*

Pileus thin, coriaceous, convex or expanded, umbilicate, zonate, cinereous-brown or livid-chestnut color, slightly silky-tomentose and radiately-fibrillose; pores minute, angular, not at all or but slightly decurrent, cinnamon-color, the dissepiments thin, acute, toothed or lacerated; stem slender, equal, sometimes slightly bulbous at the base, slightly velvety-tomentose, brownish; spores elliptical, usually uninucleate, .00025'-.0003' long, .0002' broad.

Plant about 1' high, pileus 6'-12' broad.

Burnt ground. Brewerton. Sept.

This plant occurred in company with the preceding species, and was at first taken to be a mere variety of it. Looking at the upper surface of the pileus alone it is not possible to separate one species from the other. But there is such a marked difference in the size of the pores and in the length of the spores that it scarcely seems right to lump the two together as one species. The spores are scarcely as large as in *P. splendens* and *P. perennis*, and they sometimes exhibit a slight incarnate tinge. In all the four species mentioned the pilei are sometimes confluent and sometimes have the margin fimbriate. *P. pictus*, another closely related species, but one which has not yet occurred with us, may be distinguished from the others by its glabrous stem.

The prominent characters of our four species may be expressed as follows:

Pileus plane or convex, umbilicate, opaque.	
Pores large, rather long, scarcely decurrent.....	<i>P. parvulus</i> <i>Klotsch.</i>
Pores small, rather long, scarcely decurrent.....	<i>P. simillimus</i> <i>Pk.</i>
Pileus plane or convex, umbilicate, shining, pores small, scarcely decurrent.....	<i>P. splendens</i> <i>Pk.</i>
Pileus plane or infundibuliform, opaque, pores short, small, decurrent.....	<i>P. perennis</i> <i>Fr.</i>

#### POLYPORUS CIRCINATUS *Fr.*

Ground in the borders of woods. Brewerton. Sept.

#### POLYPORUS MORGANI *Frost MS.*

Pileus fleshy, plane or convex, hairy-tomentulose, subsquamulose, reddish or brownish, the margin thin; pores short, medium size, subrotund, decurrent, white; stem subequal, elastic, solid, radicating, the subterranean portion black or blackish-brown, the exposed part whitish or pallid, inclining to tawny, velvety or somewhat reticulated, central or eccentric; spores oval, pointed at one end, .0005' long, .0003' broad; flesh white.

Plant 3'-5' high, pileus 3'-4' broad, stem 3'-5' thick.

Ground in woods. Buffalo Clinton. Brewerton. Sept.

This species is evidently closely allied to *P. radicans* Schw., and *P. melanopus* Fr., but it is in some respects quite diverse from the figure and description of the latter species. The stem sometimes penetrates the earth to a considerable depth, and is quite probably attached to decaying roots or buried pieces of wood. The flesh of the pileus is sometimes quite thick.



The species is very rare, but variable. The Brewerton specimens have the stem central and decidedly velvety, and it may be advisable to separate them as *P. Morgani* var. *velutipes*.

**POLYPORUS CUTICULARIS** *Bull.*

Old hickory stumps. Brewerton. Sept.

I have seen no specimens with blackened pileus nor with a fimbriate margin. In other respects our plant agrees essentially with the description of the species.

**POLYPORUS CHRYSOLOMA** *Fr.*

Decaying wood in shaded places. Gansevoort. Aug.

**POLYPORUS MOLLUSCUS** *Fr.*

Decaying wood. Brewerton. Sept.

**TRAMETES TROGII** *Berk.*

Decaying trunks of poplar, *Populus monilifera*. Albany. Sept.

**HYDNUM FUSCOÄTRUM** *Fr.*

Decaying wood. Buffalo. Clinton.

**HYDNUM CINNABARINUM** *Schw.*

Under side of a decaying pine log in woods. Tonawanda. Clinton.

**HYDNUM ALUTACEUM** *Fr.*

Decaying wood and bark. Adirondack Mountains. Aug.

**GRANDINIA MEMBRANACEA** *P. & C., n. sp.*

Effused, thin, membranaceous, whitish or subalutaceous, sometimes slightly tinged with greenish-yellow or olivaceous; granules numerous, crowded, unequal; spores broadly elliptical or subglobose, slightly rough, .00025'-.0003' long.

Much decayed wood, leaves, etc. Tonawanda. Oct. Clinton.  
Apparently allied to *G. papillosa*.

**CRATERELLUS CANTHARELLUS** *Schw.*

Ground in bushy places. Sandlake. Aug.

This was placed by Schweinitz in the genus *Thelephora*, section *Craterellæ*. Our specimens are quite as large as the ordinary form of *Cantharellus cibarius*, which they so closely resemble that they might easily be mistaken for a deformed condition of it. They are not quite as bright-colored as the *cantharellus*, and sometimes have a slight reddish tint. The margin is generally more lobed and irregular than in *C. cibarius*, and the spores, though yellowish as in that species, have a slight incarnate tint.

**CRATERELLUS CLAVATUS** *Pers.*

Ground in woods. Brewerton. Sept.

The resemblance of this is with *Clavaria pistillaris*.

The five species now known to occur in our State may be tabulated as follows:

Stem hollow or pervious to the base:		
Hymenium and stem yellow, spores .0004'-.0005' long...		<i>C. lutescens Pers.</i>
Hymenium and stem subcinereous or brown.		
Pileus tubiform, spores .0005'-.0007' long.....		<i>C. cornucopioides L.</i>
Pileus expanded or funnelform, spores .00025'-.0003' long.....		<i>C. dubius Pk.</i>
Stem solid:		
Hymenium and stem similarly colored, spores .0003' long,		<i>C. Cantharellus Schw.</i>
Hymenium darker than the stem, spores .0004'-.0005' long.....		<i>C. clavatus Pers.</i>

*CORTICIUM POLYPOROIDEUM B. & C.*

Decaying wood. Buffalo. Clinton.

*CORTICIUM SUBREPANDUM B. & Cke.*

Dead branches. Center. Sept.

*THELEPHORA RADIATA Holmsk.*

Ground under pine trees. Center and Providence. Aug. and Sept.

*CLAVARIA FASTIGIATA L.*

Among mosses and under pine trees. Adirondack Mountains and Gansevoort. Aug.

*CLAVARIA FORMOSA Pers.*

Ground in woods. Sandlake and Gansevoort. Aug.

*CLAVARIA CORRUGATA Karst.*

Ground in pine woods. West Albany. Sept.

*CLAVARIA FLACCIDA Fr.*

Ground in woods, also under spruce trees. Sandlake, Center and Adirondack Mountains. Common.

A form sometimes occurs with the tips of the branchlets white.

*PTERULA DIVARICATA n. sp.*

Tufts lax, whitish or rufescent, about one inch high; stems slender, irregularly branched; branches widely diverging, slender and gradually tapering to a long slender subulate point.

Among fallen leaves and on half-buried decaying wood. South Corinth, Saratoga County. Aug.

The lax habit and slender widely diverging branches distinguish this species from its allies.

*TREMELLA SUBCARNOSA n. sp.*

Small, tufted, compressed, irregular, wavy or contorted, subcarnose, whitish or pinkish-alutaceous, brownish-incarnate and more or less glaucous when dry; spores obovate, pointed at the base, .0002'-.0003' long, .00016' broad.

Tufts 2'-4" high and broad.

Decaying wood of deciduous trees. Carlisle, Schoharie County. June.

The affinities of this species are doubtful. It is provisionally referred to the genus *Tremella*, although the central portion of the substance is fleshy rather than gelatinous. The external portion, however, is gelatinous and the plants revive upon the application of moisture, and are then somewhat tremeloid, though not very tenacious. Usually two or more are clustered together and form beautiful little rosettes.

*DACRYMYCES CONGLOBATUS* *n. sp.* (Plate I, figs. 1-4.)

Scattered, sessile, even, pezizoid, about one line broad, with the thin margin incurved, pink-red, paler within, dark-red when dry, with the margin plicate-lobed; threads slender, branched, minutely rough; spores collected in subglobose tufts at the tips of the branches, oblong, obtuse, curved, sometimes nucleate, .0003'-.0004' long.

Bark of arbor-vitæ, *Thuja occidentalis*. Adirondack Mountains. July.

Our plant does not well agree with the generic character of the *Dacrymyces* in its fruit, but its external appearance is so similar to other species of the genus that it seems best for the present to place it here. The specific name has reference to the arrangement of the spores.

*MELANOGASTER VARIEGATUS* *Tul.*

Ground in shaded roads in woods. Sandlake. Aug.

*RHIZOPOGON RUBESCENS* *Tul.*

Sandy soil. Center. Sept.

*CYNOPHALLUS CANINUS* *Fr.*

Ground about an old stump. Oneida. *H. A. Warne.*

This species is described as odorless, yet according to Mr. Warne these specimens had a very disagreeable odor.

*PHALLUS RAVENELII* *B. & C.*

Ground in woods. Thurman. Oct.

The description of this species is very imperfect. The specimens were identified by comparison with Mr. Ravenel's notes which he kindly submitted to my inspection. The stem is four or five inches long, the denuded pileus is porous, the pores or cavities of the under or inner surface being larger than the others and giving a somewhat reticulate-pitted or cellular appearance, and there is a short veil at the top of the stem, but concealed beneath the pileus.

The following synoptical tables will exhibit the prominent distinctive features of the species of *Phallus* of this State and the United States, so far as I am able to get them from the published descriptions and the specimens at my command:

*New York Species of Phallus.*

Denuded pileus reticulate with coarse deep pits or cells.

Veil exposed, reticulate with small perforations . . . . . *P. Dæmonum* *Rumph.*

Veil none . . . . . *P. impudicus* *L.*

Denuded pileus porous, veil not perforate, concealed . . . . . *P. Ravenelii* *B. & C.*

*United States Species of Phallus.*

Denuded pileus reticulate with coarse deep pits or cells.

Veil exposed.

Large and reticulate with large perforations. .... *P. indusiatus Vent.*

Smaller and reticulate with small perforations. .... *P. Dæmonum Rumph.*

Smaller and plicate. .... *P. duplicatus Bosc.*

Veil none. .... *P. impudicus L.*

Denuded pileus even or merely porous.

Veil short, concealed beneath the pileus. .... *P. Ravenelii B. & C.*

Veil none. .... *P. rubicundus Bosc.*

*CLATHRUS CANCELLATUS L.*

Buffalo. *Clinton.*

*GEASTER CAPENSIS Thum.*

Ground in woods. Sterling, Cayuga County. Aug.

*ENERTHENEMA PAPILLATA Pers.*

Decaying hemlock wood. Catskill Mountains. July.

*CRIBRARIA VULGARIS Schrad.*

Decaying wood. Catskill Mountains. July.

*ACROSPERMUM ALBUM n. sp.*

White, subfusiform, subcompressed, pointed at the apex, narrowed below into a short terete stem-like base; spores numerous, elongated, filiform.

Dead stems of spikenard, *Aralia racemosa*. Catskill Mountains. July.

This is about the size of *A. compressum*, but is at once distinguished from that species by its white color.

*SPHÆROPSIS PECKIANA Thum.*

Dead grape vines. Albany. May.

*SPHÆROPSIS PULCHRISPORA P. & C., n. sp.*

Perithecia small, scattered, slightly prominent, covered by the epidermis, black; spores oblong or cylindrical, obtuse, straight or curved, three to five-nucleate, hyaline, .0006'-.0008' long, .0002'-.00025' broad.

Dead stems of *Polygonum*. Buffalo. Oct. *Clinton.*

*SPHÆROPSIS TYPIINA n. sp.*

Perithecia scattered, subconical, slightly prominent, often compressed, black; spores fusiform, pointed at each extremity, colored, .0006' long, .00016' broad.

Dead leaves of *Typha latifolia*. Sprakers. June.

The fusiform pointed spores are a noticeable character in this species.

*SPHÆROPSIS CORNINA n. sp.*

Perithecia numerous, not crowded, minute, nearly covered by the stellately ruptured epidermis, black, mouth large; spores oblong, obtuse, hyaline, .0012'-.0016' long, .0005-.00055' broad.

Dead branches of green osier, *Cornus circinata*. Sprakers. June.

The species is allied to *S. Pennsylvanica*, but the spores are considerably larger than in that species.

DEPAZEA JUGLANDINA *Fr.*

Living leaves of butternut, *Juglans cinerea*. Albany. Aug.

The perithecia occur on greenish-gray or brown spots which are sometimes large and confluent.

SEPTORIA ALBANIENSIS *Thum.*

Living leaves of the shining willow, *Salix lucida*. Sandlake. Aug.

SEPTORIA CANADENSIS *n. sp.*

Spots large, sometimes confluent, pallid or subalutaceous, surrounded by a darker purplish border; perithecia epiphyllous, small, scattered, black; spores filiform, nearly straight, .001-.0015' long.

Living leaves of dwarf cornel, *Cornus Canadensis*. Sandlake. May.

VERMICULARIA COMPACTA *C. & E.*

Dead stems of raspberry, *Rubus strigosus*. Green Island. June.

This form is referred to var. *Ruborum*.

TORULA RAMOSA *n. sp.*

Effused, thin, black, threads septate, bearing terminal and lateral strings of globose colored spores, .0003 in diameter, one or two of the lower ones sometimes elliptical or pyriform.

Decaying pine wood. North Greenbush. Sept.

SEPTOSPORIUM VELUTINUM *C. & E.*

Bark of maple and wood of hornbeam. Copake and Mechanicsville. Oct.

Two forms occur, one effused and the other tufted.

PUCCINIA SCIRPI *Lk.*

Culms of *Scirpus cespitosus*. Mount Marcy. July.

SYNCHYTRIUM ANEMONES *DC.*

Living stems and leaves of *Anemone nemorosa*. West Albany. April.

PROTOMYCES CONGLOMERATUS *n. sp.*

Spores imbedded in the tissues of the stems, large, globose, colored, .0016'-.002' in diameter, collected together in groups or clusters and forming small protuberances or tubercles on the dry stems.

Stems of the common saltwort, *Salicornia herbacea*. Syracuse. Sept.

This species is remarkable for the large size of the spores and their clustered mode of growth.

ISARIA FULVIPES *n. sp.*

Scattered or rarely caespitose, clavate, one or two lines high; club whitish or cinereous, farinose, obtuse; stem short, orange-tawny or bright ochraceous;

spores minute, ovate or subelliptical, about .0004 long, interspersed among short threads which often bear short widely diverging processes.

Dead stems of herbs. North Greenbush. June.

It may be separated from *I. clarata* and other similar species by its bright-colored stem.

**TUBERCULARIA HIRTISSIMA** *n. sp.*

Tubercles small, one-half to one line broad, orbicular, depressed, yellow or pale orange, clothed with long wooly hairs, which usually conceal them; spores elongated, cylindrical, colorless, .0008' long, about one-sixth as broad.

Fallen ash leaves, *Fraxinus sambucifolia*. South Corinth. Aug.

This species is remarkable both for its hairy investment and its elongated spores.

**TUBERCULARIA SUBDIAPHANA** *Schw.*

Dead stems of grape vines. Buffalo. Clinton.

**TUBERCULARIA FLOCCOSA** *Lk.*

Dead branches of sumach, *Rhus typhina*. Catskill Mountains. July.

**PERICONIA ALBICEPS** *n. sp.* (Plate I, figs. 8-11.)

Stems short, .02'-.03' high, equal or slightly tapering upwards, black, head white, subglobose; spores oblong or subfusiform, colorless, .0003-.0006' long.

Dead stems of snake-head, *Chelone glabra*. Sandlake. May.

It sometimes occurs in great abundance, surrounding the stems on all sides nearly their entire length.

**HELMINTHOSPORIUM OBOVATUM** *Berk.*

Decaying chestnut wood. Copake. Oct.

**CLADOSPORIUM COMPACTUM** *B. & C.*

Dead or languishing leaves of rye. Carlisle. June.

At first sight this might be taken for some small *Sphaeria*, so well do the small black compact tufts simulate sphaeriaceous perithecia. The spores vary in length from .001'-.0016'. They sometimes equal the flocci in length, and in shape are either elliptical, obovate or oblanceolate.

**HETEROSPORIUM ORNITHOGALI** *Klotzsch.*

Dead or languishing leaves of garlic, *Allium vineale*. North Greenbush. May.

**FUSICLADIUM DENDRITICUM** *Wallr.*

On apples. Catskill Mountains. July.

This attacks the apples while yet on the tree, and forms orbicular brown or greenish-brown velvety spots on them. It also occurs on the leaves.

**CERCOSPORA ROSECOLA** *Pass.*

Living rose leaves. Albany. June.

**CERCOSPORA APH Pres.**

Living parsnip leaves. Richmondville. Sept.

**PERONOSPORA FICARIA Tul.**

Living leaves of crowfoot, *Ranunculus recurvatus*. Center. April.

**PERONOSPORA CORYDALIS De By.**

Living leaves of squirrel-corn, *Dicentra Canadensis*. Helderberg Mountains. May.

This form varies somewhat from the European form on leaves of *Corydalis*, but perhaps not sufficiently to warrant its separation as a species. It usually occupies the whole lower surface of the leaves.

**PERONOSPORA GANGLIFORMIS Berk.**

Living leaves of milkweed, *Mulgedium leucophæum*. Central Bridge and Catskill Mountains. June and July.

**VERTICILLIUM LATERITIUM Ehr.**

Decaying wood. Buffalo. Oct. Clinton.

**POLYACTIS CINEREA Berk.**

Dead stems of herbs. Greenbush. May.

The fungus was found growing from a black *Sclerotium*.

**PENICILLIUM BICOLOR Fr.**

Decaying fungi, leaves, etc. Sandlake. Aug.

**SPONDYLOCLADIUM TENELLUM n. sp.**

Patches thin, effused, subolivaceous; flocci somewhat tufted, erect, slender, simple or rarely branched, septate, brown, .006-.014' high; spores in verticels of two to four at the septa, oblong, simple, pale, .00045-.0005' long, .00016-.0002' broad.

Dead stems of stone root, *Collinsonia Canadensis*. North Greenbush. October.

This species is distinguished from *S. fumosum* by its simple spores and the olivaceous hue of the patches, which to the naked eye appear like a thin floccose tomentum.

**OIDIUM DESTRUENS n. sp.**

Effused on large brown spots, odorous, whitish or pale cinereous; flocci of two kinds, the sterile spreading, much branched, closely appressed to the matrix, the fertile erect or decumbent, somewhat branched, forming monili-form strings of spores; spores unequal in size and variable in shape, elliptical subglobose or angular, sometimes with an apiculus at each end, .0002-.0006' long.

Living leaves of *Amelanchier Canadensis* and *Prunus serotina*. Center and Sandlake. May and June.

This fungus quickly destroys the vitality of the leaves it attacks, but fortunately its ravages are not extensive, only a few leaves on a tree being

attacked. Usually a large brown spot is produced by the fungus in the center of the leaf, the margin of the leaf remaining green. The affected leaves soon shrivel and wither. In the case of the cherry leaves scarcely any green margin was left, and so rapid was the spread of the fungus that nearly the entire leaf was discolored while it yet remained soft and flexible. A peculiar and decided odor is diffused either by the affected leaves or the fungus. This odor is perceptible in the dried specimens for a long time. The leaves of the shad-bush are attacked along the midvein and veins. Sometimes the unripe fruit is also attacked, the fungus causing it to rot quickly. Its destructive character has suggested the specific name.

RAMULARIA EFFUSA *n. sp.*

Hypophyllous, effused, whitish; spores very variable, globose, obovate, elliptical, oblong or cylindrical, .00016-.0011' long, about .0002 broad, occasionally uniseptate.

Living leaves of black huckleberry, *Gaylussacia resinosa*. Center. July.

This species seems to be intermediate between *Oidium* and *Ramularia*. It occupies the whole lower surface of the leaves, and often affects all the leaves on a branch. The same or a similar species occurs on leaves of *Cassandra calyculata*.

RAMULARIA VARIABILIS *Fckl.*

Living leaves of mullein, *Verbascum Thapsus*. Catskill Mountains. July.

The spots are rather small in proportion to the size of the leaf, and when fertile are beautifully frosted on both sides by the fungus.

RAMULARIA ALBOMACULATA *n. sp.*

Spots suborbicular, two to three lines in diameter, sometimes confluent, pale yellowish-green on the upper surface, whitened by the fungus on the lower surface, at length becoming purplish or brown; spores oblong or elliptical, generally binucleate, .0003'-.0004' long, .00015 broad.

Living leaves of hickory, *Carya alba*. Albany and Greenbush. June and July.

The spots are sometimes limited by the veinlets of the leaf and consequently angular. The fungus is thus far limited to the lower surface. In some instances there appeared to be creeping filaments indicating an intimate affinity with *Oidium*.

RAMULARIA ANGUSTATA *n. sp.*

Spots small, orbicular, sometimes confluent, pale greenish-yellow, frosted beneath by the fungus; flocci minute; spores narrowly fusiform or subcylindrical, .0003-.0004' long, about .0001' broad, often containing two or three nucleoli.

Living leaves of pinxter plant, *Azalea nudiflora*. Central Bridge and Carlisle. June.

The specific name has reference to the very narrow spores.



RAMULARIA NERVEGICÆ *n. sp.*

Spots irregular, often confluent, brown or reddish-brown; flocci tufted, short, blunt; spores narrow, oblong or cylindrical, straight, .0005'-.0012' long, .00015' broad, the longer ones sometimes uniseptate.

Living leaves of Norwegian cinquefoil, *Potentilla Norvegica*. West Albany. June.

RAMULARIA FRAGARIE *n. sp.* (Plate II, figs. 15-17.)

Spots small, suborbicular, arid, whitish surrounded by a purplish boarder; flocci short, tufted; spores cylindrical, straight or slightly curved, .0008'-.0012' long.

Living leaves of the common strawberry, *Fragaria Virginiana*. Knowersville, Center and Carlisle. May and June.

The spots are often sterile, so that it is sometimes difficult to find the spore-bearing fungus.

RAMULARIA LINEOLA *n. sp.*

Spots suborbicular, sometimes confluent, brown, adorned with fine concentric lines; flocci obscure, tufted, hypophyllous; spores slender, cylindrical, obtuse, often uniseptate, .0005-.0008' long.

Living leaves of dandelion, *Taraxacum Dens-leonis*. Greenbush. July. The fungus is extremely minute and scarcely visible to the naked eye.

RAMULARIA PLANTAGINIS *n. sp.*

Spots suborbicular, sometimes confluent, brown; flocci tufted, amphigenous; spores oblong or cylindrical, obtuse, .0008-.0016' long, .0002-.00025' broad, sometimes uniseptate.

Living leaves of English plantain, *Plantago lanceolata*. Carlisle. June.

GLOMERULARIA *gen. nov.*

*Flocci short: spores adhering together in masses.*

This is a genus of Hyphomycetes, order Mucedines, and is apparently allied to the genus Ramularia, from which it is distinct not only by the shape of the spores, but also by their peculiar habit of adhering together in heaps or masses. Although but the single species here described is known to me, it is so unlike any other fungus with which I am acquainted that I am compelled to make a genus for it.

GLOMERULARIA CORNI *n. sp.* (Plate II, figs. 10-14.)

Spots orbicular, sometimes confluent, brown, surrounded by a purplish margin; flocci short, obscure, hypophyllous, bearing irregular suboval masses of white spores; spores globose, rough, .0004'-.0005' in diameter, the masses .0012'-.0016' long, .0008'-.001' broad, usually containing about six spores each.

Living leaves of dwarf cornel, *Cornus Canadensis*. Catskill and Adirondack Mountains. July.

In the small spots the whole under surface is whitened by the masses of spores, in the large ones the spore masses form marginal bands or patches.

SPOROTRICHIUM SULFUREUM *Gre.*

Fallen oak leaves. North Greenbush. June.

SPOROTRICHIUM VIRESCENS *Lk.*

Decaying wood. Buffalo. *Clinton.*

SPOROTRICHIUM ALUTACEUM *Schw.*

Decaying elm wood. Bethlehem. Oct.

SPOROTRICHIUM LARVATUM *n. sp.*

Tufts confluent, dense, soft, white or yellowish, coating the whole matrix; threads very slender, simple or branched; spores abundant, minute, globose, .00008–.00012' in diameter.

Dead larvæ under alder bushes. Adirondack Mountains. July.

This species is remarkable for its peculiar habitat. In some specimens nearly the whole mass of flocci appears to have been transformed into spores, in which cases the surface is quite pulverulent.

ACREMONIUM FLEXUOSUM *n. sp.* (Plate I, figs. 16–18.)

Effused, thin, soft, woolly, white, sometimes tinged with yellow or cream-color; threads branched, the branches widely diverging, sometimes opposite, narrowed and flexuous toward the tips and armed with alternate pointed spicules; spores oval or elliptical, colorless, .0005–.0008' long, .0003'–.0005' broad.

Decaying wood. Griffins, Delaware County. Sept.

Apparently allied to *A. album*, but distinct from it by the flexuous terminal portions of the branches and their alternate pointed teeth or spicules.

SEPEDONIUM CERVINUM *Dittm.*

Parasitic on *Peziza macropus*. Brewerton. Sept.

In the typical form the spores are said to be yellowish-brown. In our specimens they are of a dull flesh color, globose, rough, .0005'–.0006' in diameter, with a short blunt appendage. It seems to be worthy of separation as a variety at least, and may be called *S. cervinum* var. *subincarnatum*.

SEPEDONIUM BRUNNEUM *n. sp.*

Effused, pulverulent, brown; spores globose, rough, .0008'–.001' in diameter.

Decaying fungi. Gansevoort. Aug.

The snuff-brown color and large spores destitute of an appendage are the distinctive features of this species.

MORCHELLA ANGUSTICEPS *n. sp.* (Plate I, figs. 19–21.)

Pileus oblong-conical and subobtuse or narrowly conical and acute, adnate to the stem, one to two inches high, and about half as broad at the base; ribs longitudinal, here and there anastomosing or connected by transverse veins; stem subequal, hollow, whitish, furfuraceous without and within, even or rarely

rough with irregular longitudinal furrows; asci cylindrical; spores elliptical, whitish tinged with ochre, .0008'-.001' long, .0005'-.0007' broad; paraphyses short, clavate, with one or two septa near the base.

Sandy soil in the borders of woods and in open places. West Albany and Center. April and May.

Two forms occur, one with the pileus oblong-conical, rather obtuse, often tipped with a slight umbo or papilla, and with a diameter a little surpassing that of the stem from which the base is separated by a slight groove; the other with the pileus narrowly conical, rather acute, scarcely exceeding the stem in diameter, and without any separating groove. The stem and fruit are alike in both forms. The stem is usually about equal in length to the pileus. The species is related to *M. conica* and *M. elata*, but may be separated from both by the size of the spores and the character of the paraphyses. In our plant I have never seen these as long as the asci. Large forms appear also to approach *M. rimosipes*, but that species has the margin of the pileus more free, the stem proportionately longer, and the paraphyses as long as the asci, if we may rely upon the figure of it. Our plant is edible.

#### GYROMITRA CURTIPES *Fr.*

Wet banks. Knowersville. May. Also Buffalo. *Clinton.*

The spores in our specimens are often trinucleate, the central nucleus being the largest. The species may be separated from *G. esculenta* by its paler color, shorter stem and different spores.

#### GEOGLOSSUM IRREGULARE *n. sp.* (Plate I, figs. 5-7.)

Glabrous, yellow, solid, fleshy, soft but rather tough, clavate; club sub-compressed, obtuse, irregular, often lobed, curved or twisted, tapering below into the short, paler or whitish solid distinct stem; asci cylindrical, often two or three united together at the base; spores uniseriate, elliptical, colorless, .0003'-.0004' long, .0002' broad; flesh white.

Plant 1'-2' high. Damp mossy ground in woods. Sandlake. Oct.

This species is allied to *G. luteum*, from which its irregular club and glabrous stem readily distinguish it. *Mitrula crispata*, of which we have seen no authentic specimens, is said to have similar spores; but if that species is properly referred to the genus *Mitrula*, it must be different from our plant, which is a true *Geoglossum*, agreeing fully with the description of that genus, but not agreeing with the published characters of the genus *Mitrula*, for the club is neither "ovate," "capitate" nor "inflated." This species, with *G. luteum*, *G. rufum* and *G. pistillare*, forms a natural group of closely related and clearly congeneric forms.

#### PEZIZA EUPLECTA *Ch.*

Shaded banks in ravines. Knowersville. May.

Our specimens vary somewhat from the characters expressed by the figure and description of this species, but scarcely enough to warrant their separation.

#### PEZIZA MELASTOMA *Sow.*

Mossy sticks on the ground. Catskill Mountains. July.

Our specimens are black without and within, and do not show any rubiginous color or orange-colored granules, but in other respects they agree with the description of the species.

PEZIZA APICULATA *Ch.*

Decaying wood. Stamford, Delaware County Sept.

The specimens differ from the type in being blackish-brown, in having the tips of the spores colored and in their habitat. Possibly they should constitute a distinct species, but the agreement with the description is so good in other respects, that for the present I have concluded to refer them to this species.

PEZIZA (HUMARIA) TETRAONALIS *n. sp.*

Cups sessile, one to two lines broad, externally cinereous, the margin sometimes wavy or flexuous, the disk blackish or blackish-brown; asci cylindrical, truncate at the apex; spores uniseriate, elliptical, smooth, colorless, .0006'-.0007' long, .0003 broad.

Partridge dung. Catskill Mountains. July.

This plant is about equal in size to *P. gallinacea*, which also has the same habitat, but its darker disk and longer spores require its separation. It does not harmonize well in color with other species of *Humaria*. It is a rare species with us

PEZIZA (HUMARIA) HUMOSOIDES *n. sp.*

Cups small, scarcely more than half a line broad, sessile, scattered or crowded, orange inclining to vinous-red, the disk plane or slightly convex, scarcely margined; asci short, cylindrical or clavate; spores crowded, elliptical, smooth, .0008'-.001' long, .0005' broad; paraphyses filiform, slightly thickened at the apex.

Dung of some wild animal. Catskill Mountains. July.

The cups are attached to the matrix by a few whitish filaments. The peculiar habitat and small size indicate its distinctness from *P. humosa*.

PEZIZA (DASYSCYPHÆ) LONGIPILA *n. sp.*

Cups gregarious, small, .014-.02' broad, narrowed below into a short stem, hirsute with long septate brown hairs; disk whitish, when dry concealed by the hairs of the margin; asci cylindrical; spores oblong, hyaline, straight or slightly curved, .00033' long, .00012' broad.

Dead stems of *Eupatorium maculatum*. Adirondack Mountains. July.

PEZIZA (DASYSCYPILÆ) URTICINA *n. sp.*

Cups minute, .007-.014' broad, sessile, subglobose and hyaline when moist, with the mouth contracted, whitish when dry, pulverulent-hairy; asci subfusiform; spores crowded or biseriate, fusiform, .0004'-.0005' long; paraphyses filiform.

Dead stems of nettle, *Urtica Canadensis*. Catskill Mountains. July.

The species is apparently near *P. translucida*. The hairs in our plant are appressed and arranged in such a manner that when moist the cups appear somewhat longitudinally striate. When dry the disk is generally concealed. The plants are so small that to the naked eye they appear like mere white grains.

PEZIZA AURATA *Fckl.*

Decaying wood and bark. Catskill Mountains. July.

PEZIZA MELALEUCA *Fr.*

Decaying wood. Summit. Sept.

The plant of Fries is regarded by some as a *Patellaria*. Our specimens, though agreeing tolerably well with the description of *P. melaleuca*, clearly belong to the genus *Peziza*. There is therefore some doubt concerning their identity, but for the present we thus refer them. It is to be regretted that the description of *P. melaleuca* makes no mention of the fruit, otherwise all doubt might be removed.

PEZIZA (MOLLISIA) TYPHÆ *n. sp.*

Cups scattered, small, .008'-.014' broad, sessile, nearly plane, black, the disk dingy-whitish; asci subcylindrical, short, .0012-.0016 long; spores minute, sub lanceolate, .0003' long.

Dead leaves of *Typha latifolia*. Carlisle June.

PEZIZA (MOLLISIA) SPHÆRELLA *P. & C., n. sp.*

Cups minute, .005'-.0055' broad, spheriform or subglobose, sessile, glabrous, black, at first closed, then opening by a small poriform mouth; asci subcylindrical, .0012'-.0014' long; spores crowded or biseriate, oblong, usually binucleate, .0004'-.0005' long; paraphyses filiform.

Dead stems of red clover, *Trifolium pratense*. Buffalo. Oct. Clinton.  
At first sight the plants might be taken for some small black *Sphæria*.

PEZIZA (MOLLISIA) ENTEROCHROMA *n. sp.*

Cups scattered or gregarious, at first cylindrical or clavate, then expanded, plane, about one line broad, subtremelloid, scarcely margined, supported on a short stem, yellowish, becoming reddish-brown or chestnut-colored when dry; asci cylindrical; spores fusiform, yellowish, .0008-.001' long, .00025'-.0003' broad; paraphyses filiform, thickened at the tips.

Fallen twigs of arbor-vitæ, *Thuja occidentalis*. Adirondack Mountains. July.

This species belongs to the subsection *Claviformes*, or perhaps better to the modern genus *Ombrophila*, being allied to *O. subaurea*, from which it differs in its color and larger spores. When dry the cups become quite concave. When crushed and moistened the flesh is greenish-yellow.

HELOTIUM LUTESCENS *Fr.*

Fallen spruce branches. Summit. Sept.

HELOTIUM FRATERNUM *n. sp.* (Plate I, figs. 12-15.)

Cups stipitate, plane or slightly concave, .5-1' broad; disk pallid or yellowish, becoming more concave and dull red in drying, externally paler; stem about equal in length to the diameter of the cup; asci clavate or cylindrical; spores crowded, cylindrical or subfusiform, .00065'-.0008' long; paraphyses filiform, numerous, scarcely thickened at the tips; flesh rather thick and firm.

Petioles of fallen maple leaves. Adirondack Mountains. July.

This species is closely related to *H. gracile* and *H. fastidiosum*, which relationship suggests the specific name. It imitates the latter species in its habitat, but I have not found it except on the petioles and occasionally the midveins of maple leaves.

*HELOTIUM PALUSTRE* *n. sp.*

Cups stipitate, plane or slightly convex, pallid or whitish; stem 3"-6" long, slightly thickened at the base; asci subclavate; spores oblong, .0004'- .0005' long.

Fallen leaves in wet places. Sandlake. May.

In the dried specimens the hymenium assumes a dark reddish-brown or chestnut color. The stem is long in proportion to the size of the cup.

*HELOTIUM VIBRISSEOIDES* *n. sp.* (Plate II, figs. 7-9.)

Cups sessile, 1-2" broad, immarginate, externally blackish or blackish-green, the disk plane or convex, livid-white or blackish-green; asci very long, linear; spores elongated, filiform, very slender, sometimes becoming coiled, bursting forth and covering the disk with a whitish webby stratum.

Decaying sticks lying in water. Sandlake and Catskill Mountains. May and July.

Externally this fungus has the appearance of a *Helotium*, but the fructification is exactly that of a *Vibrissea*. It seems to me that it really belongs to the genus *Vibrissea*, but I am prevented from placing it there because in the absence of a stem it fails to meet fully the published characters of that genus. I am fully persuaded that some of the genera of fungi are imperfectly characterized, and that we cannot have a satisfactory arrangement of our species until these defective descriptions are modified or revised.

*PATELLARIA PUSILLA* *n. sp.*

Cups sessile, small, .014-.028' broad, slightly margined, the disk plane or convex when moist, slightly concave when dry, black; asci clavate; spores crowded or biseriate, lanceolate or subclavate, 6-8-nucleate, .00065'- .0008' long, .0001'- .00012' broad; paraphyses numerous, filiform, not thickened at the apex.

Decaying beech wood. Catskill Mountains. July.

The spores in shape are similar to those of *P. atrata*. They are extremely narrow and probably become 5-7-septate when fully mature.

*DERMATEA MINETA* *n. sp.*

Cups minute, .009'- .017' broad, numerous, scattered or sometimes two or three crowded together, attached by a small point, grayish, the disk subochraceous, margin obsolete, disk plane or convex; asci oblong-clavate; spores crowded, oblong-elliptical, .0008'- .001' long, colorless, simple; paraphyses filiform, thickened at the apex.

Dead stems of hobble-bush, *Viburnum lantanoides*. Catskill Mountains. July.

This is the smallest species of *Dermatea* known to me.

BULGARIA BICOLOR *n. sp.* (Plate II, figs. 4-6.)

Cups irregular, expanded, sessile, appressed, about an inch broad, externally gelatinous, whitish or subolivaceous, the disk reddish-brown or dark watery-chestnut; asci cylindrical; spores uniseriate, elliptical, .0009'-.0011' long, .00045-.0005' broad; paraphyses filiform, thickened at the tips, brownish.

Wet decaying birch wood Brewerton. Sept.

The spores are generally furnished with one or two large nuclei. The contrast between the dark color of the disk and the light color of the cup suggests the specific name.

BULGARIA DELIGATA *n. sp.* (Plate II, figs. 1-3.)

Cups small, 1-2 broad, plane or convex, scattered or crowded, sessile, the margin obliterated, purplish-black when moist, black and more or less angular when dry, surrounded at the base by whitish filaments which bind them to the matrix; spores elliptical, uniseriate, binucleate, .001'-.0013' long, .0006'-.0007' broad; paraphyses numerous, filiform, thickened above, slightly colored.

Wet decaying hemlock wood. Catskill Mountains. July.

The numerous white filaments that appear to bind the cups to the matrix, constitute a marked feature in this species, and suggest the specific name.

EXOASCUS PRUNI *Fekl.*

Immature fruit of sand cherry and wild plum, *Prunus pumila* and *P. Americana*. Center and Carlisle. May and June. Also Buffalo. Clinton.

When the fruit of the sand cherry is attacked by this fungus, it enlarges in size, becomes elongated and pointed, soft and discolored. Sometimes it assumes a bright-red hue, but usually a pale whitish-green or yellowish-green varied somewhat by red or pinkish tints. The pit even is destroyed, and the whole texture of the pulp is changed. Rarely the leaves also are attacked, in which case they become swollen, distorted and discolored.

The fruit of the wild plum, when attacked, becomes enlarged and soft, and assumes a whitish or pale green color, but does not become elongated or pointed. Of course, its value as a fruit is wholly destroyed. At Carlisle, one tree was observed which had been cultivated in a court-yard, and which had all of its fruit affected by this fungus.

TAPHRINA AUREA *Fr.*

On catkins of poplar, *Populus grandidentata*. Albany and North Greenbush. May.

The propriety of keeping this and the preceding species generically distinct is perhaps doubtful, but I give the names as I find them.

HYPOMYCES LUTEOVIRENS *Fr.*

On decaying Russula. Center. Sept.

The spores in our specimens are longer than required by the description of the species to which we have referred them. They are .0012-.0015' in length, acuminate at each end, and at length uniseptate. The asci are very long and slender.

DOTHIDEA RETICULATA *Fr.*

Dead leaves of some liliaceous plant, apparently *Smilacina bifolia*. Summit. Sept.

HYPOXYLON UDEM *Fr.*

Decaying poplar wood. Gansevoort. Aug.

DIATRYPE VERRUCOIDES *n. sp.*

Pustules small, verruciform, covered by the epidermis, which is longitudinally or stellately split, the laciniae closely adhering; stroma blackish externally, whitish within, sometimes coated above with a thin cinerous tomentum; ostiola black, depressed, stellately sulcate; perithecia three to eight in a pustule; asci clavate; spores simple, cylindrical, straight or slightly curved, .0008' long, .00016' broad.

Dead beech twigs. Stamford. Sept.

The pustules bear some resemblance to those of *Diatrype verruciformis*, but they are generally smaller. They penetrate to the wood, and are surrounded by a more or less distinct black line.

VALSA PULVINICEPS *n. sp.*

Perithecia 8-12 in a pustule, sunk to the wood, covered by the bark; ostiola erumpent, crowded, prominent, black, forming an orbicular cushion-shaped mass; asci clavate; spores crowded, subelliptical or broadly fusiform, multinucleate, slightly colored, .0004'-.0006' long.

Dead stems of elder, *Sambucus Canadensis*. Richmondville. Sept.

This is apparently very unlike *V. abnormis*, which is said to inhabit *Sambucus*.

VALSA SORBI *Fr.*

Dead branches of mountain ash, *Pyrus Americana*. Adirondack Mountains. July.

LOPHIOSTOMA BICUSPIDATA *Ch.*

Dead stems of thimble berry, *Rubus odoratus*. Catskill Mountains. July.

This is the variety with spores .0012' long. The colorless cusps at the tips of the spores are well shown.

SPILERIA SQUAMULATA *Schw.*

Decaying wood. Catskill Mountains. Sept.

It is with some hesitation that our specimens are referred to this species, for the "black crust" required by the description is not clearly present; indeed, it is in some instances clearly absent; and the ostiola, which are described as "rather thick," in our specimens are compressed as in the genus *Lophiostoma*. In other respects the agreement with the description is good so far as the description goes. But no diagnosis is given of the fruit, and I am informed that no specimens of the species are to be found in Schweinitz's Herbarium, so that it is scarcely possible to remove all uncertainty. In our specimens the asci are clavate; the spores are crowded, oblong-fusiform, uniseptate, constricted in the middle, colorless, .0015-.0018 long, containing from four to six nuclei.



## SPHÆRIA SUBICULATA Schw.

Decaying wood. Catskill Mountains. July.

*Sphæria mutans* scarcely differs from this species except in the color of the tomentum, and sometimes in the larger size of the perithecia. It is doubtful if the two ought to be kept separate.

## SPHÆRIA (VILLOSÆ) INTRICATA n. sp.

Perithecia scattered or crowded, more or less elongated, obtuse, subventricose, generally narrowed at the base, blackish-brown, tomentose-hairy; asci slender, elongated; spores crowded, elongated, linear, more or less curved or flexuous, greenish-yellow, .0016'-.002' long.

Decaying wood and leaves in damp places. Sandlake.

This species partakes of the characters of several others, but is perhaps most likely to be confounded with *S. hirsuta* or *S. strigosa*. The perithecia, though smaller, resemble in shape those of *S. bombardæ*. The spores are very similar to those of *S. hirsuta* and *S. orina*. From *S. strigosa* it is separated by its peculiar soft matted hairs or tomentum.

## SPHÆRIA (VILLOSÆ) SCOPULA C. &amp; P., n. sp.

Perithecia scattered or crowded, small, .006-.008' broad, very black, subglobose, bristly with short, rigid black hairs; asci lanceolate or subclavate; spores crowded or biseriate, linear or slightly narrowed toward each end, multinucleate, obscurely multiseptate, greenish-yellow, .0025'-.003' long, .00016 broad.

Decaying hemlock wood. Adirondack Mountains. Aug.

The spores are often slightly curved

## SPHÆRIA (BYSSISEDÆ) ALBIDOSTOMA n. sp.

Perithecia numerous, subcrowded, small, .014-.018' in diameter, subglobose, seated upon or involved in a black or blackish-brown tomentum, the ostiola naked, not prominent, whitish when moist, darker when dry; asci cylindrical; spores biseriate, oblong-fusiform, at first uniseptate, constricted at the septum and containing two or three nuclei in each cell, then 3-5-septate, colorless, .0015'-.0018 long, .0003'-.00035' broad.

Dead branches of mountain maple, *Acer spicatum*. Catskill Mountains. September.

The whitish ostiola constitute a marked feature in this species. Its affinity is apparently with *S. nidulans*.

## SPHÆRIA (BYSSISEDÆ) CLAVARINA n. sp.

Perithecia small, subovate, clothed with rigid blackish-brown hairs and seated on a blackish-brown subiculum; asci cylindrical; spores uniseriate, oblong-elliptical or subfusiform, containing one or two nuclei, at first colorless, then brown, .0004'-.0005' long, about half as broad.

Stems and branches of *Clavaria cristata*. Sandlake. Aug.

The *Clavaria*, when attacked by this fungus, becomes distorted and discolored.

SPHERIA (CERATOSTOMÆ) SUBDENUATA *n. sp.*

Perithecia immersed or superficial, subglobose, .02–.025' broad, black, sometimes bearing a few scattered straight black hairs; ostiola cylindrical, straight or slightly curved, blunt, sometimes oblique, in length equal to or a little shorter than the diameter of the perithecia; asci cylindrical; spores uniseriate, simple, oblong-elliptical, uninucleate, colorless, .0005'–.00055' long, .0002' broad.

Much decayed wood. Catskill Mountains. Sept.

This species, by reason of its somewhat hairy perithecia, might be sought among the *Villosæ*. The perithecia are sometimes deeply sunk in the soft matrix, and have only the ostiola exposed, again they are nearly or quite superficial.

SPHERIA LIVIDA *Fr.*

Dry hard hemlock knots. Catskill Mountains. July.

SPHERIA (CAULICOLÆ) HUMULINA *n. sp.*

Perithecia small, slightly prominent, covered by the blackened epidermis; ostiola minute, piercing the epidermis; asci cylindrical; spores uniseriate, elliptical, triseptate, colorless, .0006 long, .0003' broad.

Dead hop stems. Carlisle. June.

SPHERIA INFECTORIA *Pckl.*

Culms and sheaths of *Calamagrostis arenaria*. Buffalo. Oct. Clinton.

SPILERELLA PECKII *Spegaz.*

Fallen leaves of *Amelanchier Canadensis*. Center. May.

SPILERELLA SEPTORIOIDES *n. sp.*

Spots few, orbicular, angular or irregular, white; perithecia numerous minute, hypophyllous, black; asci oblong; spores crowded, uniseptate, colorless, .0005' long, the two cells nearly equal.

Living leaves of *Thalictrum dioicum*. Central Bridge. June.

The spots are very white, and so thin that the perithecia show through the tissues of the leaf. The external resemblance to species of *Septoria* suggests the specific name.

(5.)

## REMARKS AND OBSERVATIONS.

VIOLA BLANDA *Willd.*

A noticeable form of this violet occurs about Albany. It has the calyx peduncles and petioles tinged with dull red, the flowers rather large, the petals scarcely greenish at the base, and the fragrance wanting. The leaves are sometimes rather coarsely hairy.

## VIOLA MUELLENBERGHII Torr.

A dwarf form of this species was found in South Corinth, flowering freely the latter part of August.

## SEDUM TELEPHIOIDES Mr.

This plant which is rare in our State, is reported by Hon. D. F. Day, to be growing at Chittenango Falls, high up on the face of the cliffs.

## ASTER MACROPHYLLUS L.

A form occurs near Albany with purplish stems, broadly ovate cauline leaves and flowers with six to ten rays only.

## ASTER NOVÆ-ANGLIÆ L. var. ROSEUS T. &amp; G.

Buffalo. Clinton.

## ASTER ERICOIDES L. var. VILLOSUS T. &amp; G.

Buffalo. Clinton.

## HIERACIUM AURANTIACUM L.

This plant is already fully established in several localities in our State, and is rapidly spreading. I have seen it in abundance in Rensselaer, Schoharie and Montgomery Counties, and it is reported by Mr. S. W. Cowles as fully established in Cortland County. It spreads both by seed and by runners. It thrives in hard gravelly soils, by roadsides, in pastures and in meadows, and bids fair to rival the daisy as a noxious weed. It forms a dense carpet of hairy leaves closely pressed to the surface of the ground, and sends up its flowering stems a foot or more high. These bear at their summit a cluster of beautiful orange-colored flowers, which give a very showy appearance to the fields they occupy. The growth of the plant is very rapid. One field that had been plowed in the spring was red with the blossoms of this weed the middle of June. Meadows containing it, after having been mowed, quickly send up a second crop of flowering stems. It is pronounced by farmers to be worthless as fodder, and it is doubtful if it can be kept down except by thorough cultivation of the soil.

## SHEPHERDIA CANADENSIS Nutt.

Rocky places near Central Bridge and Sprakers.

## CHENOPODIUM ALBUM L.

This species at present is made to include a variety of forms, some of which do not well harmonize either in general aspect or in details of character. A common form about Albany has wide-spreading branches, broad leaves with numerous teeth, usually five to ten on each side, large dense clusters of fruit, usually intermingled with leaves but sometimes becoming leafless, and seeds very large, fully equal in diameter to the seeds of *C. hybridum*. This form differs so widely, in its whole aspect and in all the characters mentioned, from the ordinary narrow-leaved form, *C. viride*, that unless they are clearly connected by intermediate forms it would seem better that they should be kept distinct.

PINUS MITIS *Mill.*

Specimens of this pine and of the scrub-pine, *Pinus inops*, have been received from *Mr. N. L. Britton*, who found them growing on Staten Island. This makes six species of pine known to belong to the State. Unfortunately neither of the specimens was accompanied by flowers or cones, from which I infer that they do not fruit, and that the existence of these two species within our limits will not be long continued. *P. inops* is also said to occur on Long Island, but I have seen no specimens from that locality.

JUNCUS CANADENSIS *Gay*, var. SUBCAUDATUS *Engelm.*

Ditches along the railroad. South Corinth. Aug.

The weak stems and spreading panicles give this variety an appearance quite unlike that of the more common one, var. *coarctatus*.

TRisetum MOLLE *Kunth.*

Cliffs near Central Bridge. June.

ASPIDIUM SPINULOSUM *Swartz.*

Fertile specimens of the dwarf form known as var. *dumetorum* were found on the Catskill Mountains. They are glandular-hairy and therefore should be referred to the recently-proposed species, *A. Americanum* *Dav.* The typical *A. spinulosum*, as limited by *Mr. Davenport*, occurs on the Adirondack Mountains.

BOTRYCHIUM TERNATUM *Swartz*, var. OBLIQUUM *Eaton.*

The dwarf form of this variety with the sterile frond about one inch broad and long and the whole plant three or four inches high was found at South Corinth.

BOTRYCHIUM SIMPLEX *Hitch.*, var. SUBCOMPOSITUM *Lasch.*

Lewis's Bluff near Oswego. *Rev. H. Wibbe.*

BRYUM ELONGATUM *Dicks.*

This rare moss occurs on Slide Mountain, one of the highest peaks of the Catskills.

AGARICUS CESAREUS *Scop.*

This species was found at Gansevoort growing in a circle about forty feet in diameter. About one-fourth of the circumference of the circle was unoccupied by the fungus in consequence of the encroachment of a cleared field. In the American form of the species the stem is rather slender and equal or slightly tapering upward. I have not seen it "subventricose" as required by the description.

AGARICUS AMERICANUS *Pk.*

This Agaric usually grows in grassy places or on lawns, but fine specimens were found the past season growing in a large tuft on an old stump. The lamellae are much narrowed behind and somewhat reticulately connected. In the fresh state the whole plant is white with the exception of the scales of the pileus.

*AGARICUS HORDUS Fr.*

Although the specimens formerly referred to this species agree in most respects with the description there are certain discrepancies, which upon further investigation induce me to believe it to be a distinct species. I would, therefore, give it the following name and description :

*AGARICUS (TRICHOLOMA) PRÆFOLIATUS n. sp.*

Pileus thin, slightly convex or expanded, a little moist in wet weather, virgate with innate brownish fibrils, dark-cinereous or grayish-brown, usually a little darker on the disk, the margin sometimes revolute ; lamellæ very broad, subdistant, rounded behind, sometimes united at the point of attachment, venose-connected and somewhat transversely striate, often split transversely, the edge uneven or eroded, white ; stem equal, firm, fibrous, fibrillose-striate or rimose, stuffed or hollow, white or whitish ; spores broadly elliptical, generally uninucleate, .00025'-.00035' long ; flesh white, odor pleasant, anise-like.

Plant 4'-6' high, pileus 3'-5' broad, stem 5'-10' thick.

Ground and decaying hemlock wood in woods and groves. June and Aug.

The pileus is often irregular and sometimes eccentric. The lamellæ are very broad, sometimes a half an inch or more, and usually much torn. The plant is scattered in its mode of growth, but few individuals occurring in a place. The obscure striations of the lamellæ are retained in the dried specimens.

*AGARICUS CORTICOLA Schum.*

This plant revives on the application of moisture, thus indicating an affinity with species of *Marasmius*.

*AGARICUS CALLISTUS Pk.*

This beautiful Agaric grows on decaying wood in damp places as well as in exsiccated water-holes.

*CORTINARIUS CORRUGATUS Pk.*

In woods. Gansevoort and Sandlake. Aug.

The color of the pileus varies from yellow to reddish-yellow or ochraceous, the lamellæ are sometimes minutely transversely venose, and the stem is slightly fibrillose, and sometimes sprinkled above with yellowish grains or squamules.

*PAXILLUS POROSUS Berk.*

Fine specimens were found at Brewerton, growing on the ground in woods and on mounds of earth. The plant emits an unpleasant earthy odor. I have not found the pileus viscid, and conclude that the part of the description "viscid when moist" is a mistake. This species is easily known by its porous hymenium, which connects it with the genus *Boletus*. *Paxillus flavidus* Berk. is probably not distinct from *Gomphidius rhodoxanthus* Schw., which occurs within our limits. The species is ambiguous between *Paxillus* and *Gomphidius*, but from the character of its spores it seems nearer the

latter genus to which I have referred it. Our New York species of *Paxillus* may be tabulated thus:

Stem central:	
Pileus glabrous or only the margin tomentose.....	<i>P. involutus</i> <i>Batsch.</i>
Pileus hairy, less than two inches broad.....	<i>P. strigosus</i> <i>Pk.</i>
Stem eccentric or lateral:	
Velvety-tomentose, hymenium lamellated.....	<i>P. atrotomentosus</i> <i>Batsch.</i>
Glabrous, reticulated, hymenium porous.....	<i>P. porosus</i> <i>Berk.</i>
Stem none.....	<i>P. pannoides</i> <i>Fr.</i>

#### LACTARIUS INDIGO *Schw.*

This *Lactarius* appeared in considerable abundance in August, both in Sandlake and in Gausevoort. The younger and fresh plants are generally highly colored and distinctly zonate, especially on the margin, but they fade with age, and generally lose their zonate character. The pileus when moist, is smooth, and subviscid to the touch, the stem is hollow and often spotted, and the spores are yellowish. Wounded places become greenish. It belongs to the section *Dapetes*, so named doubtless because of the edible qualities of its species. The four New York species of this section are very similar in character, and differ but little except in color and place of growth. They may be tabulated as follows:

Lamellae when young blue, milk blue.....	<i>L. Indigo</i> <i>Schw.</i>
Lamellae when young orange, milk orange.....	<i>L. deliciosus</i> <i>L.</i>
Lamellae when young purplish-red, milk dark red.....	<i>L. subpurpureus</i> <i>Pk.</i>
Lamellae when young grayish-yellow, milk pale saffron.....	<i>L. Chelidonium</i> <i>Pk.</i>

The first and last species usually occur on dry soil under or near pine trees; the second and third prefer damp soil in and about swamps and among mosses.

#### LACTARIUS SORDIDUS *Pk.*

A notable variety occurs in Sandlake. It has a hairy pileus and a greenish stem. The hairs of the pileus are of a brownish-green color, and toward the margin they separate in tufts or squamules. The pileus, as well as the stem, is more highly colored than in the typical form. It may take the name var. *hirsutus*.

#### LACTARIUS AQUIFOLIUS *Pk.*

The agreeable aromatic odor, which is present both in the fresh and in the dried plant, is similar to that of *L. glycosmus*.

#### RUSSULA FETENS *Pers.*

The odor of this plant as it occurs with us is not usually fetid or unpleasant. It resembles the odor of cherry bark and might aptly be termed amygdaline. The lamellae are rarely forked and frequently they are quite as equal as in species of the section *Fragiles*. In this respect it violates the characters of the section *Heterophyllae* in which the species is placed. It is doubtless this form to which Dr. Curtis gave the name *Russula amygdalina*. But our plant is scarcely a distinct species, for it does occur with numerous short lamellae intermingled with the longer ones, and the same peculiar odor has been attributed by one writer at least to the European *R. fetens*.

#### BOLETUS SPECTABILIS *Pk.*

This rare species occurs near Indian Lake in Hamilton County. It was discovered in North Elba in 1869, since which time I had not met with it. It constitutes with *B. pictus* and *B. paluster* a natural group of allied species. When young the tomentum in all of them covers the whole pileus.

BOLETUS ALBUS *Pk.*

This is another *Boletus* of rare occurrence. When young the tubes are white, but they at length become yellow or ochraceous-yellow. The flesh is white and the plant when fresh emits a fetid odor.

BOLETUS SUBTOMENTOSUS *L.*

A form of this species occurs in which the costæ of the stem anastomose in such a way as to form large but rather obscure reticulations. Is it *B. lanatus* Rost.? Another form having the pileus and stem darker-colored than usual occurs on much decayed prostrate trunks of trees and about old stumps. The chinks of the pileus are sometimes whitish.

BOLETUS AFFINIS *Pk.*

A fine variety of this species was found at Gansevoort, in which the pileus was beautifully mottled by small yellowish spots. It merits the name var. *maculosus*.

BOLETUS MODESTUS *Pk.*

This rare species sometimes has the flesh of the pileus yellowish. The stem is minutely scurfy or furfuraceous.

POLYPORUS CERULEOPORUS *Pk.*

A form of this species was found at South Corinth, in which the whole plant was grayish-blue except the flesh which was white.

POLYPORUS RHIPIDIUM *Berk.*

There is a slight viscosity to the pores of this species. The pileus fades with age.

POLYPORUS SPUMEUS *Fr.*

A large form of this plant, with pilei sometimes six or eight inches across, occurred at Brewerton.

POLYPORUS BOREALIS *Fr.*

This sometimes occurs on hemlock stumps. It then differs from the form on spruce in having the pileus broader, wholly white and strigose-hairy or fibrous-hispid.

POLYPORUS VOLVATUS *Pk.*

The form recently published under the name *Polyporus obvolutus* Berk. & Cke. is not specifically distinct from this species, according to specimens received from Mr. Ellis.

CLAVARIA BOTRYTES *Pers.*

When old the branches both of this species and of *C. flava* become elongated, obtuse, very fragile and of a uniform color. The yellow tips of the latter and the red ones of the former species wholly disappear.

MYROTHECIUM FUNGICOLA *Pk.*

This species has recently been referred to *M. inundatum* Tode. The spores in that species are represented in *Sturn's Dutchland Flora* as globose. In our plant they are oblong or cylindrical, a difference which seems to me to be of specific value.

## PERONOSPORA VITICOLA B. &amp; C.

Leaves of wild grape-vines. Catskill Mountains. A Peronospora which is scarcely distinguishable from this species occurs about Albany on leaves of the great ragweed, *Ambrosia trifida*.

## MORCHELLA SEMILIBERA DC.

Mr. Warne finds two forms of this species at Oneida, one with the pileus conical, the other with it hemispherical and obtuse. In both the stem may be either short or long. The pileus is often free nearly or quite to the apex.

GYROMITRA ESCULENTA Fr. (*Helvella esculenta*.)

This plant sometimes grows so large that a single one will weigh a pound.

## HELVELLA ELASTICA Bull.

This species is described as having the pileus free. It is not uncommon to find it with the pileus attached in one or two points to the stem.

## VERPA DIGITALIFORMIS Pers.

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## HELOTIUM PILEATUM Pk.

Decaying stems lying in water. Sandlake. May.

This is a large form about an inch high, with a conical or subcampanulate pileus 2'-3'' broad.

## VALSA OXYSPORA Pk.

The habitat of this species was, by an error, stated to be dead oak branches. It is dead branches of mountain holly, *Nemopanthes Canadensis*. I have not found it on oak. It is very distinct from *V. taleola*, if the published characters of that species are at all reliable.

(6.)

## NEW YORK SPECIES OF LYCOPERDON.

## LYCOPERDON Tourm.

Peridium membranaceous, vanishing above or becoming flaccid; bark adnate, subpersistent, breaking up into scales or warts; capillitium soft, dense, adnate to the peridium and sterile base. *Syst. Myc., Berk. Outl., Cooke's Handbook.*

The species of Lycoperdon are commonly known as "Puff-balls." They belong to a family of fungi called Gasteromycetes, because of their habit of producing their spores in the inner cavity of the plant. The particular order to which they belong is called Trichogasters, a name having reference to the hair-like filaments with which the interior of the mature plant is filled. These filaments form a somewhat elastic mass, and are interspersed with vast numbers of minute dust-like spores. When, therefore, the mature plant is



suddenly compressed, it emits a little cloud of spores which bears some resemblance to a puff of smoke. This probably suggested the name "Puff-balls."

There are two other closely related genera in this order, whose species emit the characteristic puff of spores. One is called *Bovista*, the other *Scleroderma*. In the former, the outer rind or epidermis disappears as the plant matures, and there is no distinct spongy or cellular mass of sterile tissue at the base of the plant. In the latter, the walls of the plant are thick and firm when young, and they remain in nearly the same condition when mature. In these respects both genera differ from the genus *Lycoperdon*. In it the fertile part of the plant is more or less globose in shape, but there is always a mass of coarse empty cells at the base, which constitute a sterile part of the plant—that is, they produce no spores. In those species which have this part highly developed, it constitutes a sort of stem to the fertile part, and raises it above the earth or the matrix on which the plant grows. When the sterile base is but slightly developed, the plant appears to sit directly on the ground or matrix, and is then said to be *sessile*. The exterior of the plant consists of two parts. The outer part is sometimes called the *bark*, sometimes the *exterior peridium*. In some species it takes the form of minute flocculent or pulverulent masses of scurf-like scales, in others it consists of weak spines or spine-like bristles, while in others still the spines are much longer and stouter, being thickened at the base. Plants with these coarse long spines are said to be *echinate*, because of their stiff bristly aspect. Sometimes several contiguous spines have their tips curved toward each other and united together, thus forming little stellate or star-like clusters. These external processes or adornments are often called *warts*. In some species they are deciduous at maturity, in others they form a permanent adornment of the inner rind or true *peridium*, but in such cases they usually shrivel with age and become less conspicuous. In a few species, the exterior peridium, at maturity, is separable from the inner, and may be peeled off like a thin membrane. The inner or true peridium is at first rather thick and firm, but when fully mature it is generally thin, membranaceous and flaccid. In one series of species, the upper part, when mature, breaks up into irregular fragments and soon falls away; in another series it bursts by a small apical aperture, and then remains in this condition a long time. This difference in the peridia of the various species affords a character by which the genus is divided into two sections. The first section was designated by Fries as *Bovistoides*, the other as *Proteoides*. The former was raised by Rostkovius to the rank of a genus with the name *Langermannia*, but modern mycologists have generally followed Fries in regarding these species as a section or sub-genus of *Lycoperdon*.

The peridium incloses at first a soft fleshy mass of white cellular matter. If a minute portion of this be examined microscopically, a great number of short jointed filaments and enlarged cells or basidia are seen, the latter of which bear slender spicules, usually four apiece, on the tips of which the spores are borne. When the plant is fully developed, this central fleshy substance becomes filled with moisture and quickly changes its color. So abundant is the moisture that it may be pressed out like water from a wet cloth or sponge. The inexperienced collector is sometimes surprised at finding the moisture in the specimens which he has laid up to dry increasing instead of diminishing, and his surprise is soon changed to disappointment and perhaps annoyance, when he sees his beautiful specimens water-soaked and discolored by this superabundance of moisture. In most species the white color of the flesh at first changes to a yellow or greenish-yellow, but this hue soon becomes darker until at last it is either a purple-brown or a dingy-olive; that is, brown more

or less tinged with dark-red, or brown tinged with yellow or greenish-yellow. In a few species the final color is less decided, approaching a dark-umber or snuff-brown. Sometimes the outer stratum, lying next to and in contact with the inner surface of the peridium, is paler than the rest of the mass. With this change in the color of the interior mass there is also a change no less wonderful in its character. It is now no longer moist and fleshy, but dry and dusty. The whole interior is filled with a soft but elastic mass of intricate, slender, cottony filaments interspersed with countless multitudes of minute dust-like spores. This mass of threads is called the *capillitium*. In some species it is of nearly uniform density throughout, but in others those filaments that spring from the base do not so freely unite and intermingle with those that spring from the walls of the peridium. They, therefore, form a central mass more or less distinct from the rest, and are called the *columnella*. The columnella is usually of a somewhat conical shape, but sometimes it is nearly globose. It may be detected in the mature plant by carefully making two opposite slits in the peridium, extending them from the apex nearly or quite to the base, and then opening the two hemispheres thus formed, the uncut base acting as a hinge on which the halves may turn. The columnella, if present, will be seen projecting from the base in the center of the cleft. The slits are best made with a pair of small, sharp scissors, as care should be taken not to disturb the natural position of the filaments more than is necessary. In the mass the capillitium and spores appear to be uniformly and similarly colored, but often if the filaments are cleared of the spores they are seen to be paler in color. Rarely they are darker. The color of the capillitium and spores might be used as a character for grouping our species in subsections. The spores in all our species are nearly or quite globose. They vary in size in the different species from .00016 to .00025 of an inch in diameter. The olive-tinted spores in nearly all the species are smooth and about .00016 of an inch in diameter, but the purple-tinted ones are always rough or echinulate and generally larger, varying from .0002 to .00025 of an inch broad. It is perhaps needless to say that the size of the spores does not at all depend on the size of the plant that produces them. The spores of the Giant puff-ball, the largest one of the genus, are but .00016 of an inch in diameter, while those of the little Smooth puff-ball, which is scarcely more than an inch in diameter, are about .00025 of an inch broad. The color of the spores may be ascertained by ejecting a small quantity of them on white paper or by opening the peridium and exposing them to view.

Puff-balls rarely make their appearance in the early part of the season. Old effete specimens of the preceding autumn may be found in early spring, flattened and closely pressed to the ground by the snows of winter. Fresh specimens rarely appear before the middle of June. Their greatest abundance is in late summer and early autumn. During the months of August, September and October most of our species occur. One species I have found in July and August only, another in July only. Some species are invariably found in cleared lands, others in woods or bushy places, while a few are denizens of both field and forest. Some grow on the ground only, others on old logs and decaying wood, and a few on both the ground and decaying wood. One southern species is said to inhabit the bark of living oak trees. Some species have distinct, whitish, root-like fibres at the base. These penetrate the earth, and sometimes creep through it for a considerable distance. In the Pear-shaped puff-ball they are generally well developed, and sometimes several individuals are found to be attached together by these creeping subterranean fibres.

In the determination of the species, it is desirable to have specimens in both the mature and the immature condition. The former will afford the

means of ascertaining the color and character of the capillitium and spores, the latter will exhibit the color of the immature plant, and the character of its warts or adornments. The character of these, and the characters of the capillitium and spores are of the first importance, but the color of the immature plant and its size and shape are less constant and reliable, and are therefore generally considered of secondary importance. Specimens preserved entire and in their natural shape are much more satisfactory for study than those that are sliced in sections or pressed flat and mounted on herbarium paper. Such specimens can easily be kept in trays or small paper boxes. The immature ones should be gathered just before maturity. If taken too early they shrivel too much, and do not keep their shape as well.

Puff-balls are useful because they are edible. None of the species are considered dangerous or even hurtful, yet some are so small and so scarce, that they are not of much value for food. The larger ones are generally better flavored than the smaller and more common ones. They should be used as food in the immature condition only, while the flesh is yet of a pure white color. When it begins to discolor its goodness is gone.

The method of preparing them for the table is as follows: Take off the rind and cut the fleshy part into thin slices. Beat up two or three or more eggs, according to the quantity to be prepared, and dip the slices in it. Then fry in butter, seasoning with salt, pepper and savory herbs if desired. Another method is to put the slices in water and heat to the boiling point. Then take them out and fry in butter as before. Puff-balls, as an article of food, have this advantage over mushrooms. They are not often infested by insects or their larvæ, and there is scarcely any possibility of mistaking any deleterious species for them. In the following descriptions, those species whose esculent qualities have been tested by the writer are marked edible.

The Synoptical table is intended to be an aid to the student in tracing the species. Nearly all the characters employed in it are ascertainable without the aid of the microscope.

### SYNOPTICAL TABLE OF SPECIES.

#### SECTION I. *Peridium Rupturing Irregularly.*

Plant very large, spores dingy-olive.....	L. giganteum.
Plant large, spores purple-brown.....	L. cyathiforme.
Plant medium size, stem long, spores dingy-brown.....	L. saccatum.

#### SECTION II. *Peridium Opening by a Small Apical Aperture.*

Mature capillitium and spores purplish-tinted.....	a.
Mature capillitium and spores olive-tinted.....	b.
a Denuded peridium reticulate with brown lines.....	L. constellatum.
a Denuded peridium smooth.....	L. atropurpureum.
a Peridium not denuded, warts minute, persistent.....	L. glabellum.
b Plant shaggy or echinate with spinose or pyramidal warts.....	c.
b Plant not shaggy, warts minute or papilla-like.....	e.
c Plant sessile, growing in cleared land.....	L. Wrightii.
c Plant subsessile, growing in wood or bushy places.....	d.
d Denuded peridium pitted, spores pedicellate.....	L. pedicellatum.
d Denuded peridium smooth, spores not pedicellate.....	L. echinatum.
e Plant generally with a stem-like base.....	f.
e Plant without a stem-like base, sessile.....	g.
f Denuded peridium pitted and reticulate with dotted lines.....	L. gemmatum.
f Denuded peridium not pitted.....	L. molle.
f Peridium scarcely denuded, warts minute, equal.....	L. pyriforme.
g Plant pinkish-brown, growing in woods.....	L. subincarnatum.
g Plant whitish, growing in cleared land.....	L. pusillum.
g Plant yellowish, growing in woods.....	L. coloratum.
g Plant whitish, ovate or conical.....	L. calyptriforme.

SECTION I. *Bovistoides*. *Peridium rupturing irregularly, the upper part falling away in fragments. Columella none.*

In the species of this section the peridium is apt to crack in areas, and at maturity it breaks up in irregular fragments and falls away. The capillitium and spores are also soon dispersed, so that there remains only the sterile base which is sometimes margined by the lacerated, but more permanent basal part of the peridium. In this case the remains are somewhat cup-shaped. The bark or warts are usually of a soft floccose character, but sometimes not conspicuously developed.

LYCOPERDON GIGANTEUM *Batsch*. GIANT PUFF-BALL.

Very large, 10-20 in diameter, obconic or depressed-globose, nearly or quite sessile, white or whitish, becoming discolored by age, smooth or slightly roughened by weak spinose or minute floccose warts, sometimes cracking in areas; capillitium and spores yellowish green to dingy-olive; spores smooth, .00016 in diameter. Edible.

Ground in fields, pastures and grassy places. Buffalo, *Clinton*. Oneida, *Warne*. North Galway, *Telf*. Rensselaerville, *Doolittle*. Catskill Mountains, *Paine*. Late summer and autumn.

This is the largest puff-ball known in this country, and is therefore very appropriately named the Giant puff-ball. The species, according to Fries, has also received other names, such as *L. maximum* Schæff, the largest puff-ball; *L. Bovista* L., the Bovista-like puff-ball; *L. vulgare* Vaill, the Common puff-ball, and *L. proteus* Sow., the Protean puff-ball. Its dimensions are usually within the limits given in the description, but sometimes it grows much larger. Its great size frequently brings it into notice, and makes it the subject of short newspaper articles. The following have recently fallen under the observation of the writer, and are introduced here because they indicate the size sometimes attained by this puff-ball: "In a low moist portion of the Gordon Park there grew this fall one of the largest puff-balls (*Lycoperdon giganteum*) ever seen. It measured a little over eight feet in circumference, and weighed forty-seven pounds. It looked at a distance like some large boulder. \* \* \*

A specimen of the above dimensions would be a meal for a good large family. In fact, I think it sufficient to appease the appetites of some of the largest European fungus clubs."—*Country Gentleman*. "There was an enormous puff-ball in a bank near the house of the writer this summer. It was eighteen and a half inches in its greatest diameter, and four feet four inches in circumference. These puff-balls have come up in the same place for many years past, and always of a large size, but never before so large as the above."—*Grevillea*. "Among noteworthy specimens seen at the recent Edinburgh Fungus Show, was \* \* \* a puff-ball (*Lycoperdon giganteum*) fifty-four inches in circumference and weighing twenty pounds."—*Botanical Gazette*. Schweinitz affirms that he found in a certain meadow specimens of this puff-ball three feet in diameter. The largest New York specimen that I have seen is the one contributed by Mr. Warne. It measures fifteen inches in diameter in its dried state. It was considerably larger in its fresh state. The specimen from Rensselaerville is fourteen inches in diameter in the dried state. One writer advises that when one of these large puff-balls occurs at a convenient distance from the house, it should not be removed from its place of growth, but that a sufficient quantity be cut from it for a meal. The next day it may be visited again and enough more be taken for another meal. In this way it may supply a small family for a week; but if all were taken up and carried to the house at once, some of it

would spoil before it could be used. It is said that when the growing plant is cut or wounded, the wounds heal or fill up with new tissue. Cordier states that the old flesh of this puff-ball is sometimes used for amadou, and that the spores are mixed with milk by the Finns, to make a medicine for calves afflicted with diarrhœa. They are also used, he says, in making various shades of brown paint. The capillitium and spores of this and other species are also said to have been used in staunching blood, and their fumes as an anæsthetic. Fries says that there are two forms of this species, one obconic, and the other larger and globose. All the specimens that I have seen were depressed-globose, their vertical diameter being less than the horizontal. As one correspondent expresses it, they were very much like a large round loaf of bread in shape and in color. In all our specimens the sterile base is very small in proportion to the size of the plant, so that, in the growing state the plant must have appeared quite sessile. Probably the smaller obconic form has a more distinct base. According to Fries, the species is so variable in size, shape, color and the character of the surface, that from these alone it is difficult to distinguish it. There is, however, no New York species at present known to me with which it is likely to be confused, if the characters of the mature peridium, and the color of the capillitium and spores are observed.

#### LYCOPERDON CYATHIFORME Bosc. CUP-SHAPED PUFF-BALL.

Large, 3'-10' in diameter, nearly globose, generally furnished with a short more or less thick stem-like base, whitish cinereous or pinkish-brown, smooth or minutely floccose, sometimes with minute scattered spinules or floccose scales, generally cracking in areas, the upper part at length falling away in fragments and leaving a cup-shaped base with a lacerated margin; capillitium and spores purple-brown; spores rough .0002'-.00025' in diameter. Edible.

Ground in fields and pastures. Buffalo, *Clinton*. Oneida, *Warne*. Utica, *Johnson*. Fort Edward, *Howe*. Albany, Sandlake, Maryland and South Corinth. Autumn.

Bosc's figure and description of this species, for a transcript of which I am indebted to the kindness of Prof. Farlow, are not very satisfactory. They were evidently derived from the basal remains of the effete plant, a mode of describing fungi which is scarcely to be recommended. But in this case it happens that there is no other known American puff-ball than the one here described to which, in the effete condition, his description is applicable, so that there is very little doubt as to the species he intended to describe. A translation of his description is here given.

"Sessile, conical, concave at the top, the margin thin and lacerated.

"This species, which occurs in very dry and open places in South Carolina, appears to have some resemblance to *L. infundibulum* Willd. Its color is a grayish-violet, more distinct in the cavity. I have never seen it open naturally to disseminate its seeds. Insects which perforate it, the feet of quadrupeds which crush it, winds which blow it against trees supply this want."

The use of the word sessile in this description is very natural, if we should suppose as Bosc evidently did, that the sterile base was the only and normal condition of the plant. "Conical" would probably have been more accurate, if it had been written "obconical" or "inversely conical." This species, according to Dr. Berkeley, is apparently the same as *L. fragile* Vitt. It is also the *L. albobaccatum* of Frost's List of Fungi in the Catalogue of

Plants growing near Amherst College. It is the *Bovista cyathiformis* of the Twenty-second State Cabinet Report, and an immature condition of it was reported and figured in the Twenty-third State Cabinet Report under the name *L. giganteum*.

As an edible species, it is not inferior to the giant puff-ball. It is equal to it in flavor and occurs more frequently and in greater numbers. The smaller plants are about the size of a man's fist, the larger ones are as big as a man's head. The short thick stem often penetrates the earth so that the plant appears to be truly sessile. The color is generally brown more or less tinged with pink or lilac, but sometimes it is nearly white. Usually the upper part cracks into rather large distinct areas. Just at maturity there is a thin membrane or epidermis which may be separated from the peridium, which is then seen to have a beautiful but minutely velvety surface. It is at this time quite thick but very fragile. The cup-like base, which remains after the dispersion of the capillitium and spores, is suggestive of the specific name. It is more or less tinged with the purplish-brown hue of the capillitium and frequently persists till the following spring. Sometimes the persistent basal part of the peridium is expanded so that the cup is lost in a nearly plane surface. The color of the capillitium and spores readily separate it from the other species of this section.

#### LYCOPERDON SACCATUM Fr. LONG-STEMMED PUFF-BALL.

Medium size, 2'-4' high, 1-2' broad; peridium depressed-globose or somewhat lentiform, supported by a long stem-like base, furfuraceous with minute persistent mealy or granular warts or spinules, often plicate beneath, white or creamy white, at maturity becoming brown or olive-brown, subshining and very thin or membranous, breaking up into irregular fragments which sometimes adhere to the capillitium for a considerable time, the stem-like base cylindrical or narrowed downward, sometimes thick; capillitium rather dense, subpersistent, and with the spores dingy-olive or dingy-brown, sometimes verging toward purplish-brown; spores rough, .00016'-0002' in diameter. Edible.

Low mossy grounds and bushy swamps, especially under alders. Sandlake, Center and Alton Lakes Mountains. August—October.

The Long-stemmed puff-ball is one of our finest species. Its symmetrical shape, pure color, soft and delicate appearance, all conspire to render it attractive. The peridium is sometimes nearly globose, but usually it is more or less depressed and hemispherical or lens-shaped. Its warts are soft and delicate, and so minute, that to the naked eye the plant appears to be mealy or almost pruinose. They are persistent, but in the mature plant they shrivel or dry up so that they are scarcely noticeable. In the mature plant the peridium shrinks to a thin delicate membrane, in which respect it differs from the peridium in the two preceding species. The under surface is sometimes marked by radiating alternate elevations and depressions, and in some instances the stem is also rendered uneven by shallow, undulate depressions. The stem sometimes persists long after the disappearance of the peridium and its contents.

Before maturity this species bears a strong resemblance to *L. molle* Pers., the Soft puff-ball, but when mature the two are easily separated by the different manner in which the peridium ruptures.

SECTION II. *Proteoides*. *Peridium* opening by a small apical aperture, persistent. *Columella* generally present.

In this section the species are more numerous than in the preceding, and the plants are generally more abundant, but they do not attain such large dimensions. The peridium persists for a long time, and as its aperture is very small, its capillitium and spores are not so soon dispersed. In some of the species there are larger deciduous warts or spines interspersed among smaller and more persistent ones; in others, all are nearly equal and persistent; in a few, all are deciduous.

\* *Spores purple-tinted, intermingled with short fragmentary slender filaments.*

LYCOPERDON CONSTELLATUM Fr. RETICULATE PUFF-BALL.

Peridium subglobose or obovate, sometimes depressed, 10"-18" broad, echinate with rather long stout crowded brown spines which are either straight curved or stellately united and which at length fall off and leave the surface reticulate with brown lines; capillitium and spores brown or purplish-brown, columella present; spores rough, .0002'-.00025 in diameter.

Ground in dense shades and groves. *Oncida*. *Warne*. Rare. Autumn.

I am not aware that this species has been found in any other locality in the State. I have seen the dried specimens only, but Mr. Warne informs me that the fresh plants do not differ essentially in color from the dried ones. These are of a cervine or dull-brown color, closely resembling the hue of the dead and fallen leaves among which they appear to have grown. They are about an inch across, and very rough or shaggy, with crowded stout spines. When these have fallen, the surface is reticulated by a network of minutely warted brown lines, a character by which the species is readily distinguished.

LYCOPERDON ATROPURPUREUM Vitt. PURPLE-SPORED PUFF-BALL.

Peridium globose depressed-globose or obovate, 6'-30' broad, generally narrowed below into a short stem-like base, white cinerous or brownish, mealy-spinulose hairy-spinulose echinate or stellately echinate, when denuded smooth and subshining; capillitium and spores finally purplish-brown, columella present; spores rough, .0002'-.00025 in diameter.

Sandy pastures, woods and bushy places. Common. August—October. Albany, Sandlake, Gansevoort, Brewerton, Catskill Mountains and Helderberg Mountains.

This appears to be one of the most polymorphous species we have. It is so variable that I have been obliged to modify the usual description very much, in order to include forms which are quite diverse, yet which appear to me to run together in such a way that I am unable to draw any satisfactory line of distinction between them. The following is the usual description of the Manuals:

"Peridium flaccid, dingy-rufous, opening by a minute obtuse mouth; bark at first rough, with minute spines: sterile base cellular, continuous with the capillitium; spores largish, pedicellate, brown-purple, echinulate."

I do not find the spores in our plant truly pedicellate; but in all the forms which I have referred to this species, as well as in all the species of this sub-

section and in European specimens of this species, I find them intermingled with short, fragmentary, slender filaments, which look very much as if they were pedicels broken from the spores. I have not been able to find the spores attached terminally to them; but, in several instances, they appeared to be attached laterally. There also appears to be a minute point or apiculus on the spores, probably the point of attachment; but this is scarcely worthy of being called a pedicel.

There are three principal varieties which I have referred to this species. The first is usually one to two inches broad, sessile, or with a very short stem, nearly smooth, being mealy or pruinose, and having a few minute, weak, scattered spinules or scales. Its color is generally whitish, or white slightly clouded with brown. It grows in sandy pastures and cleared lands, and is probably the nearest of the three in its resemblance to the type.

The second is turbinate or subglobose, and narrowed below into a distinct, though short, stem-like base. It varies in diameter from half an inch to an inch and a half, and is thickly beset with slender bristle-like spinules which are often blackish, and give the plant a decidedly hairy aspect. The largest specimens have the spinules a little stouter, and sometimes stellately united. Such specimens connect this with the next variety.

The third variety varies from one to two and a half inches in diameter, and is generally furnished with a short stem-like base. Its spines are quite coarse, and often crowded and stellately united. They give it a decidedly rough or echinate appearance, so that at first sight it would be thought a distinct species; but the spines are easily deciduous, and individuals occur in which they are more scattered, and which have a mealy or pruinose surface, by which characters this variety appears plainly to run into the first. I regard the second and third as worthy of a name, and designate and define them as follows:

Var. *hirtellum*. Peridium hairy-spinulose with erect or curved sometimes stellately united spinules, which are often of a blackish color.

Ground and decaying vegetable matter in woods.

Var. *stellare*. Peridium echinate or stellately echinate with rather stout easily deciduous spines.

Ground in woods and bushy places.

In this species the capillitium and spores are at first greenish-yellow, olive-tinted or brownish; but when fully mature they are purple-tinted. Some care will, therefore, be necessary, lest the last variety be confused with the Echinate puff-ball, *L. echinata* L. This variety was mentioned in the Twenty-second State Cabinet Report, under the name *L. calvescens* B. & C. The specimens were thus referred by one of the authors of that species; but when the description of the species was published, the reference was found to be erroneous. The larger, purple-tinted, rough spores forbid such a reference.

#### LYCOPERDON GLABELLUM *Pk.* SMOOTH PUFF-BALL.

Plant subglobose or subturbinate, 8-18' broad, sometimes narrowed below into a stem-like base, yellow or brownish-yellow, furfuraceous with minute nearly uniform persistent warts; capillitium and spores purplish-brown columella present; spores rough, .0002'-, .00025' in diameter.

Ground in pine woods and bushy places. North Greenbush, Albany and Center. Autumn.

The Smooth puff-ball is not inferior in beauty to any of our species. Its pretty yellow color and soft, smooth appearance readily attract attention. It



is generally about one inch in diameter, and obovate, pyriform or subturbinate in shape. To the naked eye it appears to be smooth, or only mealy, or minutely papillose; but under a lense it is seen to be covered with minute, granular, or branny warts. These, in all the specimens that I have seen, are persistent. The character of the warts and the different color of the peridium enable this species to be easily distinguished from the preceding one, to the smaller and smoother forms of which it otherwise approaches.

\* \* *Spores olive-tinted or brown.*

*a. Plant shaggy or echinate.*

#### LYCOPERDON WRIGHTII B. & C. WRIGHT'S PUFF-BALL.

Peridium globose depressed-globose or lentiform, 6'-24" in diameter, generally sessile, white or whitish, echinate with deciduous sometimes crowded stellate spines or pyramidal warts, when denuded smooth or minutely velvety; capillitium and spores dingy-olive, columella present; spores smooth, .00016' in diameter. Edible.

Ground in pastures and grassy places. Very common. July—October.

This is another very variable species. The typical form was a small one, minutely echinate and having the denuded peridium smooth. The plant often occurs much larger and more coarsely echinate with stout angular spines or pyramidal warts which fall off and generally leave the surface of the peridium velvety. This larger form was published in the Twenty-sixth Report of the N. Y. State Museum under the name *Lycoperdon separans*, but it is impossible to keep the two forms distinct. The larger ones sometimes have the denuded peridium smooth and there are other forms intermediate in the size and roughness of the peridium. I have therefore modified the specific description so as to include both forms.

Another puff-ball occurs which is probably a variety of this species but of which I have seen only immature specimens. It is of a purer white color and has the warts or spines tipped with black. For the present I have placed it with this species as a variety. It is probable that *L. calvescens* B. & C., is merely another form of this species differing simply in having a stem-like base. The following are the characters of the varieties noticed:

Var. *typicum*. Small, 6"-9" broad, globose, minutely echinate, the warts quickly falling off and leaving the peridium smooth. (*L. Wrightii* B. & C.)

Var. *separans*. Larger, 10'-24' broad, subglobose or lentiform, echinate with coarse substellate spines or pyramidal warts which at length fall off and leave the peridium smooth or velvety. (*L. separans* Pk.)

Var. *atropunctum*. Larger, 10'-15' broad, subglobose, pure white, warts or coarse spines brown or blackish at the tips.

This species is generally gregarious, but sometimes it forms tufts of several individuals closely crowded together. It sometimes occurs in cultivated grounds and stubble fields. The under surface is occasionally plicate as in the Long-stemmed puff-ball. In the variety *separans* the warts or spines are crowded at their thickened bases and slightly attached to each other so that they come off at maturity in flakes or patches. When the denuded surface of the peridium is velvety it is usually of a darker color than when smooth, being subcinamon, reddish-brown or dark-brown.

LYCOPERDON PEDICELLATUM *Pk.* PEDICEL-SPORED PUFF-BALL.

Peridium 10'-18" in diameter, globose or depressed-globose, sessile or narrowed below into a stem-like base, whitish or cinereous, becoming dingy or smoky-brown with age, echinate with rather dense spines which are either straight curved or stellately united and which at length fall off and leave impressions or obscure reticulations on the surface; capillitium and spores greenish-yellow, then dingy-olive, columella present; spores smooth, pedicellate, .00016'-.00018' in diameter, the pedicel three to five times as long.

Ground and decaying wood in woods and bushy places. Croghan, Center, Brewerton and Catskill Mountains. Autumn. Oneida, *Warne*.

The pedicellate spores constitute the peculiar feature of this species. It is one which suggests the name and which enables the species to be easily distinguished from all its allies. The spore is terminally and persistently attached to the pedicel, as in some species of *Bovista*. The plant is sometimes sessile, but usually it is narrowed below into a stem-like base. In the immature state it has a rough, shaggy appearance, but the spines shrivel with age so that it appears less rough when old. The pitted surface of the denuded peridium affords a mark of distinction from the next species. *L. pulcherrimum* B. & C. is evidently the same species, but the name here adopted has priority of publication.

LYCOPERDON ECHINATUM *Pers.* ECHINATE PUFF-BALL.

Peridium 10'-18" broad, subglobose, generally narrowed below into a short stem-like base, whitish brownish or pinkish-brown, echinate above with rather stout spines, which at length fall off and leave the surface smooth; towards the base spinulose or furfuraceous; capillitium and spores dingy-olive; spores minutely rough, .00016' in diameter.

Ground and decaying wood in woods. Albany, Forestburgh and Adirondack Mountains. August—October.

Fries, in the *Systema Mycologicum*, refers this species to *L. gemmatum* as a variety; but it seems to me to be worthy of specific distinction, both on account of the different character of its warts, its much more echinate appearance, and its smooth, denuded peridium. He also gives as synonyms *L. candidum* Pers., and *L. nauricatum* Willd.

The whole plant is generally obovate, pyriform or turbinate, and the spines are larger and more or less curved at and near the apex, diminishing in size toward the base where they are more persistent. In the immature condition it is difficult to distinguish it from the preceding species; but when mature its smooth peridium and spores destitute of pedicels separate it. It grows chiefly in woods among fallen leaves, and on decaying vegetable matter.

*b. Plant not shaggy.*

LYCOPERDON GEMMATUM *Batsch.* STUDDED PUFF-BALL.

Peridium 10'-18' in diameter, globose or depressed-globose, generally narrowed below into a stem-like base, scattered or caespitose, subumbonate, whitish or cinereous, often tinged with yellow pinkish or brown, warts generally unequal, the larger mostly gemmate or papilla-like, pointed at the apex, scattered among smaller granular and more persistent ones, at length falling off and

leaving the surface areolate-dotted or reticulate with a network of fine dotted lines; capillitium and spores greenish-yellow, then dingy-olive or brown, exanella present; spores smooth or very minutely rough, .00016' in diameter. Edible, but not pleasant flavored.

Ground and decaying wood in woods and fields. Very common. July—October.

This is one of the most common and, at the same time, one of the most variable species. It is, therefore, more difficult to describe than to recognize after its peculiar appearance is familiar. The most available marks of distinction are the larger, erect, pointed warts or spinules, scattered among the minute ones, and giving the surface an appearance somewhat as if studded with gems, and, when these have fallen, the little smooth dots or impressions which they leave on the peridium. These are surrounded by the smaller and more persistent warts, which usually form fine reticulating dotted lines, and render the denuded peridium scabrous. In some instances, the warts on the upper part of the peridium are more crowded than usual, and nearly uniform in size; but when they fall they leave the usual smooth dots or impressions where they had stood. The denuded peridium is generally cinerous or grayish and opaque. The stem varies very much in thickness and length. In some instances, it is almost or entirely wanting; in others, it is elongated nearly as much as in the Long-stemmed puff-ball. It is cylindrical or narrowed downwards, and it may be nearly equal to the peridium in diameter, or very much thinner. As in the preceding species, the larger warts generally occur on the upper part of the peridium and near the apex. When these are close and nearly uniform in size, they give the plant a coarsely papillose appearance, and if, at the same time, the stem is wanting, the plant becomes the variety called *papillatum*, or *L. papillatum* Schœff. Such forms occur both with and without the stem, and cannot easily be kept distinct from the ordinary forms. In the variety *hirtum*, or *L. hirtum* Mart., the larger warts are reduced to slender bristle-like spinules, which are often blackish in color; but they have an expanded base, and when they fall off they leave the usual dot-like impressions and reticulations. This form is rare with us. *L. excipuliforme* Pers., which is regarded by Fries as a variety of this species, either does not occur with us or else I have confused it with the ordinary forms of the species. It is characterized by its elongated stem with a subplicate base, and its scattered subspinulose warts. Sometimes the larger warts are blackish, or tipped with black, and occasionally they manifest a tendency to group themselves in a stellate manner. When the plant is caespitose, it sometimes forms tufts of considerable extent. Such tufts, fully two feet in diameter, and containing scores of plants crowded together so compactly that their usual rounded form was lost, have fallen under my observation.

The following are the characters of the two varieties mentioned as they are given in *Systema Mycologicum*:

*Var. hirtum*. Turbinate, sessile, hairy with soft slender warts which generally become blackish.

*Var. papillatum*. Subrotund, sessile, papillose, furfuraceous-pulverulent.

#### LYCOPERDON MOLLE Pers. SOFT PUFF-BALL.

Peridium 6''–16'' broad, globose or depressed-globose, narrowed below into a stem-like base, furfuraceous with nearly uniform persistent minute weak spinules or granular warts, sometimes with a few larger papilliform ones

toward the apex, whitish, sometimes tinged with yellow, when mature brownish or olive-brown, nearly smooth, subshining; capillitium and spores dingy-olive, columella present; spores minutely rough, .00016'-.00018 in diameter.

Among mosses, especially *Polytrichum*, in old meadows and pastures. Albany, Summit and South Corinth. Autumn.

This puff-ball closely resembles the ordinary forms of the preceding species in the size, shape and color of the immature plant, and by Fries was referred to it as a variety. There may be connecting forms, but if so, I have not observed them, and for the present prefer to keep the two distinct. In this plant, the warts or spinules are very small and weak, so that it has a smoothish, soft and delicate appearance, much like that of *L. sacratum*. They are mostly persistent, but wither or shrivel with age, so that the mature peridium appears to the naked eye to be nearly smooth and somewhat glossy or shining. In this respect it differs essentially from the Studded puff-ball. I have never seen it with the dotted and reticulate surface of that species. From the Long-stemmed puff-ball it is with difficulty separated in its immature state, but when mature, the different manner in which the peridium of the two species ruptures will at once distinguish them. From its habit of growing among mosses, the stem is often elongated, and is sometimes very slender in proportion to the size of the peridium. In wet weather the peridium of this and the preceding species manifests a tendency to crack in areas.

#### LYCOPERDON PYRIFORME *Schæff.* PEAR-SHAPED PUFF-BALL.

Plant 6"-15" broad, 10'-20' high, generally caespitose, obovate, pyriform or turbinate, sessile or with a short stem-like base, radicaating with white branching and creeping root-like fibres, subumbonate, covered with very minute subpersistent nearly uniform warts or scales, often with a few slender scattered deciduous spinules intermingled, pallid dingy-whitish or brownish; capillitium and spores greenish-yellow, then dingy-olivaceous, columella present; spores smooth, .00016' in diameter. Edible, but not well-flavored.

Decaying wood and ground both in woods and cleared lands. Very common. July—October.

The Pear-shaped puff-ball sometimes approaches *L. gemmatum* in size and shape, but it is not easily mistaken for that species because of the different character of its warts. They are very numerous, small, nearly uniform in size, and appear to the naked eye like branny scales. They are often quite as distinct on the stem as on the peridium. They are quite persistent, but sometimes fall from the upper part of the peridium, leaving it smooth and whitish or cinerous. The peridium frequently cracks in areas, especially in wet weather. One form occurs with the peridium abruptly narrowed into a small, but distinctly scaly stem; another is of a very pale color and almost smooth, the warts being scarcely visible to the naked eye. In mountainous forests, patches of this puff-ball which are several feet in length frequently occur on old prostrate mossy trunks. Whole clusters of young plants may sometimes be obtained attached together by their creeping radicular fibres.

#### LYCOPERDON SUBINCARNATUM *Pk.* PINKISH PUFF-BALL.

Peridium 6-12" broad, globose, rarely either depressed or obovate, gregarious or caespitose, sessile, with but little cellular tissue at the base, covered with minute nearly uniform pyramidal or subspinulose at length deciduous

warts, pinkish-brown, the denuded peridium whitish or cinereous, minutely reticulate-pitted; capillitium and spores greenish-yellow, then dingy-olivaceous, columella present; spores minutely roughened, .00016–.00018 in diameter.

Prostrate trunks, old stumps, etc., in woods. Common. August—October.

This is a very distinct species not likely to be confused with any other. Its peculiar color is quite constant, and this, with its minute, uniform warts, caespitose habit, sessile character, and pitted, denuded peridium, easily distinguishes it from all allied species. It rarely exceeds an inch in diameter, and I have never found it growing on the ground, nor in cleared lands. It often has white, creeping, radicular fibres, similar to those of *L. pyriforme*, and it sometimes forms patches equal in extent to those of that species. The little pits or depressions in the denuded peridium are left by the deciduous warts. They are smaller and deeper than the similar impressions of *L. gemmatum*, and are not surrounded by dotted lines.

#### LYCOPERDON PUSILLUM *Fr.* LITTLE PUFF-BALL.

Peridium 3–12" broad, globose, scattered or caespitose, sessile, radicating, with but little cellular tissue at the base, white or whitish, brownish when old, rimose-squamulose or slightly roughened with minute floccose or furfuraceous persistent warts; capillitium and spores greenish-yellow, then dingy-olivaceous; spores smooth, .00016' in diameter.

Ground in grassy places and pastures. Common. June—October.

This puff-ball is generally about a half an inch in diameter; but specimens sometimes occur that are scarcely larger than a pea, and others that are fully an inch across. It grows in open ground, either on naked soil or among short grass, and is sometimes crowded together in tufts. Its surface is often cracked in areas which are sometimes quite minute, giving the surface a scaly appearance. Rarely the warts are in the form of minute, branny spinules or stellate hairs. They are generally persistent, but in the mature plant they are so shriveled that they are scarcely noticeable. It occurs throughout the season, sometimes appearing as early as June. Its smoother surface will readily distinguish it from small forms of *L. Wrightii* and *L. gemmatum*, var. *papillatum*.

#### LYCOPERDON COLORATUM *Pk.* COLORED PUFF-BALL.

Peridium 5"–10" broad, globose or obovate, subsessile, radicating, yellow or reddish-yellow, brownish when old, slightly roughened with minute granular or furfuraceous persistent warts; capillitium and spores at first pale, inclining to sulphur-color, then dingy-olive; spores subglobose, smooth, about .00016' in diameter.

Ground in thin woods and bushy places. Sandlake and Catskill Mountains. July and August.

This delicate little puff-ball is quite rare. It is generally about a half an inch broad and nearly globose, though sometimes it is narrowed toward the base, where it is usually furnished with a few delicate, white, radicular fibres. The color of the immature plant is yellowish and quite conspicuous; but when old it so closely resembles the dead, brown color of the fallen leaves among which the plant grows, that it is difficult to detect it. But few individuals

are found in one place. The warts are very minute, and easily overlooked. They have a granular or almost mealy appearance, and, when old, usually become blackish. At first the capillitium and spores appear to have a sulphur-yellow color; but when fully mature, if the capillitium is cleared of the spores, it is seen to be much darker. There appears to be a slight depression in one side of the spore, so that, when viewed in a particular direction, it appears flattened or depressed on one side, although viewed in a different direction it may appear globose.

LYCOPERDON CALYPTRIFORME *Berk.* CONICAL PUFF-BALL.

Peridium about 6" high, 3'–4" broad, ovate or subconical, sessile, whitish, furfuraceous with minute warts or spinules; capillitium and spores olivaceous or yellowish-olivaceous; spores smooth, .00016 in diameter.

Moss-covered rocks. Very rare. Adirondack Mountains. August.

I have met with this very small and rare species but once, and then but two specimens were found. In these the apex was compressed or laterally flattened, instead of papilliform, as required by the original description of the species; but in all other respects they agree well with the specific characters. The plant is very distinct from all our other species by its small size and ovate or conical shape.

In closing this report, grateful acknowledgments are rendered to those botanists whose names already appear in the preceding pages, for their kind coöperation in the investigation of our flora, and for their generous contributions of specimens.

When no name is added to the station or stations herein given, the plant has been found therein by the writer. Dates signify the time when the specimens were collected or the plants observed.

Respectfully submitted,

CHAS. H. PECK.

ALBANY, *January* 4, 1879.

[From the Tenth Report of the New York Commissioners of Fisheries.]

## THE MOSSES OF CALEDONIA CREEK.

BY CHARLES H. PECK.

The plants received from Caledonia creek (the fish-hatching station), are a water-cress, a chara, and four mosses. The latter grow in tufts or patches more or less dense, either in wet places or submerged in water. When growing in or under water, they afford a place of refuge or a habitation, and probably food, also, to various water insects and their larvæ, small mollusks and crustaceans. The mosses received had an abundance of these small animals among their branches. I have before observed inhabitants of similar character in tufts of moss in swamps and mountain rivulets, but never before have I seen them so various and so numerous. Whether this abundance is due chiefly to the character of the stream whence the specimens were taken, or to the character and plenteousness of the food it affords them, or to both combined, may be a question. But one thing is evident. There cannot long be an abundance of consumers without an abundance of food to be consumed. The abundance of animal life in Caledonia creek implies an abundance of food on which these organisms exist, and, if we wish to perpetuate or increase this abundance, we must preserve or increase the necessary supply of food.

There is, among the mosses of that locality, one of special interest, both because of its rare occurrence, and because of the noticeable coincidence between its abundant growth there, and the abundance of animal life that accompanies it. It is possible that this coincidence is purely accidental, and yet, on the other hand, it is not wholly improbable that there is some important connection between the two facts, which would render a brief account of the moss desirable.

It is known to botanists by the name *Hypnum noterophilum*, or Moisture-loving moss, under which name it was described by Messrs. Sullivant and Lesquereux.

Franklin and Lancaster counties, Pennsylvania, are its previously reported localities, given on the authority of Prof. T. C. Porter. In those localities it is said to grow in limestone springs. It was discovered in the Caledonia locality, several years ago, by Hon. G. W. Clinton, but up to the present time this remains its only known locality in our State. It is quite evident, therefore, that it is a moss of very rare occurrence in our State, although it occurs in abundance in this single locality. At Caledonia it grows (according to my information) in shallow, mostly quiet or slowly flowing water, attached to pebbles and rocks, and forms quite extensive patches of a dark-green or blackish-green color. The stems are generally two to four inches long, though smaller forms sometimes occur. They are irregularly branched, the branches being rather long, and ascending or nearly erect, so that the moss has a somewhat stiff or rigid aspect. The narrow, nearly erect leaves, also add to this peculiar appearance. They are furnished with a stout, thick midrib, which extends through the leaf and projects a little beyond its apex. In some of the specimens nothing remained of many of the lower leaves except this thick midrib. Whether the blade of these leaves had been eaten away by the crustaceans and insect larvæ that hide everywhere among the branches, or whether it had gradually

fallen away by decay. is uncertain. The principal features of the moss are represented in the accompanying illustration (Plate 3).

I have never seen the moss in fruit, and am of the opinion that it rarely, if ever, fruits in submerged situations. It is a noticeable fact, that it has occurred in limestone regions only, and in water in which more or less lime is held in solution. Any experiments in transplanting it in other waters would be more likely to be successful, if this fact be kept in view; still it is possible that it might thrive in other waters. One of the mosses associated with it, at Caledonia, frequently occurs in water free from lime. The pebbles and small stones could be easily removed by taking them up bodily with the attached moss and its occupants, and transporting them to the desired localities. If planted in large streams, care should be taken to place them in still, shallow water, for in streams of strong current and large volume, the smaller stones are rolled about by the force of the current, so that mosses seldom acquire or retain a foot-hold in such situations.

The three other mosses associated with the preceding one, are *Hypnum rusciforme*, the Ruscus-like moss, *Hypnum filicinum*, the fern-branched moss, and *Hypnum riparium*, the river-bank moss. The first one has occurred in our State, in rivulets in the Catskill and Shawangunk Mountains. The second has been found in many localities, but it prefers springy places and dripping rocks in limestone districts. The third occurs everywhere, in swamps, water-holes, and sluggish streams. The specimens of these were less in quantity than of the other, from which I infer that they are not in unusual abundance there, and probably their occurrence is of no special significance. ¶



[From the Tenth Report of the New York Commissioners of Fisheries.]

## THE INSECTS AND OTHER ANIMAL FORMS OF CALEDONIA CREEK, N. Y.

By J. A. LINTNER.

*To the Commissioners of Fisheries of the State of New York:*

GENTLEMEN—In March, 1877, I received a communication from the Chairman of your Honorable Board, calling my attention to the remarkable abundance of trout in Caledonia creek, upon which the State Hatching-house is located, abounding there, it was believed, as in no other natural locality in the United States. It had also been noticed by the Commissioners, that the mosses and other aquatic plants of the stream contained an unusual number of insects, and it was thought that their abundant presence might be the principal cause of the great abundance of trout. If this surmise should prove to be well-founded, then, the question was raised, would it not be desirable, and was it not practicable, to transport these insects and accompanying plants to other streams within the State, and thereby add, in all probability, to their waters, forms of animal life, and appropriate shelter not at present occurring in them.

By the direction of your chairman, a large can, containing, in water, mosses and other plants from Caledonia creek, and their living occupants, was sent to the State Museum of Natural History, in the month of March, for the examination of the State Botanist and myself. The result of the examination of the mosses by the botanist has been presented to your board.

I found the mosses and plants swarming with insect forms, crustaceans, etc., to such an extent as I had never seen before, and which I could not believe to be a fair representation of the fauna of Caledonia creek. I accordingly addressed a letter to Mr. Seth Green, under whose supervision the can and its contents had been forwarded, making the inquiry whether the animal life contained in the can was only that which belonged to the accompanying plants, or if it embraced collections from other sources. The answer was returned that no other living forms had been placed in the can, except those contained in the plants when gathered.

The most abundant form was that of a small crustacean—*Gammarus fasciatus* Say. It was so numerous that no one could have carelessly raised a handful of the moss without noticing the very large number of these creatures present. A representation of it, of twice the natural size, is given in plate 4, fig. 12.

The *Gammaridae*, commonly known as shrimps, belong to the order of Amphipoda, one of the higher groups of the Crustacea, found in both fresh water and salt. Three species of *Gammarus* are known to occur in our ponds, brooks, rivers or lakes, viz.: *G. limnicus* Smith, *G. fasciatus* Say, and ? *G. minus* Say. Of the salt-water forms, five species are recorded in Verrill's *Report on the Invertebrate Animals of Vineyard Sound*,\* viz.: *G. ornatus* Edw., *G. annulatus* Smith, *G. natator* Smith, *G. marinus* Leach, and *G. mucronatus* Say. They are all comparatively small forms—the largest measuring considerably less than an inch in length.

\* U. S. Commission of Fish and Fisheries. Report 1871-72, pp. 557-559.

*Gammarus fasciatus* has quite a wide distribution, probably occurring throughout most of the Northern States, as it is reported from Maine, Connecticut, several localities in New York, from Pennsylvania, Michigan, Illinois and Wisconsin. Its habits of life admit of its existence in the standing water of ponds, as well as in the running water of streams. Of its life-history very little is known; or, indeed, of any of the species of the *Gammaridæ*. Our knowledge of them scarcely extends beyond descriptions of the several species, except that the embryology of some of the European forms has been studied and published. All the *Gammaridæ* are eagerly devoured by fishes.

The mosses contained a large number of the cases of caddis-worms—Neuropterous insects of the family of *Phryganidæ*. A reference to these cases and their occupants will be made hereafter.

So few of these insects have been reared from their larvæ, that it is scarcely possible to identify a species from the examination of its case or its larva—not that they do not afford reliable specific features, but simply because these features have not been connected with the perfect forms. Had this been done, the caddis-case would, in all probability, indicate its imago as readily as does the cocoon its moth, or the gall its gall-fly.

The cases contained in the moss were apparently of only two forms. These, together with the larvæ taken from them, were submitted to Dr. Hagen, of the Museum of Comparative Zoölogy, at Cambridge, Mass.—our highest authority in the Neuroptera.

One of these forms, composed of bits of wood and bark cemented together, and represented in fig. 7 of plate 5, was found by Dr. Hagen to belong to the *Limnophilidæ*—a family comprising the two great genera of *Limnophilus* and *Hallesus*. The larva had not been seen by him before, and could, therefore, from its general characters, only be referred with doubt to *Hallesus*.

The other form, consisting of small pieces of stone united in a somewhat flattened cylindrical case, was referred to the *Scricostomidæ*, and might possibly be that of *Dasystoma numerosum*; but the larvæ of these groups are so imperfectly known, that nothing definite could be affirmed of this case.

The pupæ of a species of *Cloë*—one of the *Ephemeridæ*, were quite abundant in the moss, and actively darting about in the water. Of this genus five species are described in Hagen's *Synopsis of the Neuroptera of North America*. They are of small size, measuring, in expanse of wings, from one-fourth (*C. pygma*) to three-fourths of an inch.

The *Ephemeridæ* are commonly known as May-flies, and from their brief life in their winged state—usually represented as of but a few hours' duration—are sometimes spoken of as Ephemera. Mr. B. D. Walsh, however, has retained living examples of *Palingenia bilineata* (Say) in his breeding cages, for nearly a week.\*

De Geer has kept *Ephemera respertina* alive for eight days, and Stephens mentions having kept specimens of *Cloëon dipterum* alive for more than three weeks.† These insects often occur in such immense numbers, that they have been observed “stranded in winrows along the borders of our lakes.” The swarms of a European species with white wings (*E. albipennis*) has been compared to a snow storm; whilst in some parts of Europe where they abound, it is the custom to collect their dead bodies into heaps and use them for manure. The fishes at such times eagerly wait for them; and so great are the numbers which fall into the water that the fishermen call them *manna*. (Westwood, loc. cit., p. 29.)

\* Practical Entomologist. Vol. ii, p. 95. 1867.

† Westwood's Introduction to the Classification of Insects. Vol. ii, p. 27.

The distinguished naturalist Reaumur gives so interesting and wonderful an account of the appearance of these insects on one occasion, near the river Marne, in France, that we transcribe it here: The myriads of Ephemerae which filled the air over the current of the river, and over the bank on which I stood, are neither to be expressed nor conceived. When the snow falls with the largest flakes and with the least interval between them, the air is not so full of them as that which surrounded us was with Ephemerae. Scarcely had I remained in one place a few minutes, when the step on which I stood was quite concealed with a layer of them from two to four inches in depth. Near the lowest step, a surface of water, of five or six feet dimensions every way, was entirely and thickly covered by them, and what the current carried off was continually replaced. Many times I was obliged to abandon my station, not being able to bear the shower of Ephemerae, which, falling with an obliquity less constant than that of an ordinary shower, struck continually, and in a manner extremely uncomfortable, every part of my face,—eyes, mouth and nostrils were filled with them.”\*

From their number, habit of flight over the surface of the water, and liability to be blown therein, the Ephemeridae constitute an important part of the food of many of our fishes; consequently their frail forms are often imitated by the fly-fishermen, by which to lure the trout from his retreat. Of the forty-four species of insects given by Ronald in his *Fly-fishers' Entomology*, eighteen belong to this family.

Some of the *Ephemeridae*, in their preparatory stages, live in burrows in the mud of the banks, “divided internally into two canals, each having a separate opening externally, and uniting internally at the extremity, so that the insect can crawl in at one hole and out of the other, without being obliged to make the awkward turn it would have to do in a straight hole” (Westwood, loc. cit., p. 29). Others of the family, which are of a stronger build, live at large in the water, and are quite active in their movements.

To illustrate this interesting family, in fig. 6 of plate 5, *Hexagenia bilineata* (Say) is given. This is the *Palingenia bilineata* of Hagen's *Synopsis of the Neuroptera of North America*, p. 41, where its habitat is given as British North America, Penn., Md., Dist. Colum. and Mo. The example figured was captured at Schenectady, N. Y., in the month of June.

I was unable to comply with the request of your board, that I would visit Caledonia and make an examination of the fauna of the creek, during the summer, when the insect life would be at its height, and the mature forms easy to be collected for their identification.

On the first of December, I visited the State Hatching-house, and examined the ponds and the portion of the creek in the immediate vicinity. The season was too far advanced for an abundant insect fauna, and the weather, unfortunately, proved very unfavorable for the collection of such forms as were present. In the afternoon of my arrival, I noticed three species of Neuroptera on the wing, much to my surprise. One of these, a Phryganid, *Chilostigma conglobata*, kindly determined by Dr. Hagen, was quite abundant, flitting about in the occasional sunshine, although the temperature was but a few degrees above the freezing point. A pair of these was taken in copula; the other two species will be noticed hereafter. A species of Diptera, somewhat smaller than the common housefly, was also captured on the wing (see page 81).

The following day, December second, proved exceedingly unfavorable for my examinations; a severe snow storm, continuing throughout the day, with the

\* Introduction to Entomology: Kirby and Spence. Phila., 1843, p. 197.

high wind accompanying it, frequently compelled me, although incased in india-rubber, to seek the shelter of the Hatching-house. My explorations were confined to the mosses and other plants upon and near the borders of the principal pond (formed by a dam thrown across the creek), to pieces of timber floating in it, and to the bed of the stream.

The following forms were collected during my brief stay :

### FISHES.

Among the water-plants, drawn with the aid of a rake to the bank of the pond, for the examination of their contents, were a number of specimens of the little fish, commonly known as Millers' Thumbs. Often unobserved at first, after the plants had lain upon the ground for several minutes, upon raising them up, the fishes would be discovered lying quietly on the surface of the ground beneath. Both the locality and quiet habit are strikingly at variance with what is related of the Cottoids. Girard, in his *Monograph of the Fresh-water Cottoids of North America*,\* says of them: "Clear and limpid waters are the places most preferred by these fishes. The small rivulets of cold water descending along the slopes of mountains, are often their favorite residence. \* \* \* \* They keep sheltered under stones, which must be removed when in search of them. When uncovered, they sometimes dart away with great rapidity, in search of another hiding-place; and sometimes they wait motionless until started."

For nearly a century, all the fresh-water Cottoids, both in this country and in Europe, were supposed to constitute but a single species—the *Cottus gobio* Linn. Subsequently, more critical observation has largely added to the number of the species, Girard citing seven in Europe, and fifteen in North America; of these latter, he refers thirteen to *Cottus*, and one each to *Cottopsis* and *Trigloopsis*. Jordan and Copeland, in their "*Check List of the Fresh-water Fishes of North America*,"† arrange the Cottoids under the four genera of *Pegedichthys* Raf., *Uranidea* Dekay, *Cottopsis* Girard, and *Trigloopsis* Girard, having respectively 13, 9, 3 and 1 species—Nos. 106–127 of Check List. Of these, but a single species, the *Cottus gracilis* of Heckel (*Uranidea quiescens* of Dekay) is credited to New York.

From the difficulty attendant upon the determination of these closely allied species, I have not attempted to name the Caledonia examples, but have submitted them to Prof. Putnam, of Cambridge, Mass., who has made special study of this interesting group.

In the last sending from Caledonia, a large number of "stickle-backs" were received—beautiful little creatures—varying in length from one inch to one inch and seven-eighths, with silvery sides, their upper portion marbled in shades of green, and with five or six dorsal spines from which they derive their name. They belong to the family of *Gasterosteidae*, which, in the Check List above quoted, are arranged in the genera *Gasterosteus* Linn., *Pygosteus* Brevoort, *Apeltes* Dekay, and *Eucalia* Jordan. Two only of the contained species, viz.: *Apeltes quadratus* and *Eucalia Cayuga*, are ascribed to New York.

The Caledonia examples do not, apparently, belong to either of these species. They have, therefore, been submitted to Prof. Putnam's study, in company with the forms above mentioned.‡

The stickle-backs are noted for the singular habit which pertains to all the species; of constructing nests for the reception of their eggs.

\* Smithsonian Contributions to Knowledge, 1852. Vol. iii, No. 30.

† Bulletin of the Buffalo Society of Natural Science. Vol. iii, pp. 133–164.

‡ Prof. Putnam, having examined the specimens, refers the "millers' thumbs" to *Cottus gracilis* Heckel, and the stickle-backs to *Gasterosteus inconstans* Kirtland (*Eucalia inconstans* of Jordan).

Their nests are not very elaborate structures, as they are composed of such material as is accessible to the pair within the narrow limits near the bank of the stream, which they have selected as their special domain, and from which every venturesome intruder is at once driven away. Pieces of straw or of dried grasses blown into the water are appropriated for the purpose and interwoven among the vegetation of the stream in such a manner as to harmonize with the surrounding objects, and with difficulty to be detected by one walking upon the bank. When removed from the water, their delicate structure causes them to fall together into a shapeless mass. When the female has deposited her eggs in the nest, they are guarded with ceaseless vigilance. The boldness of the male, in their defense, is remarkable: "He will dash at a fish of ten times his size, and by dint of his fierce onset and his bristling spears, drive the enemy away. Even if a stick be placed within the sacred circle, he will dart at it, repeating the assault as often as the stick may trespass upon his domains."

### REPTILES.

At the time of my December visit, lizards were quite abundant in the mosses at the water's edge. A number of examples were brought with me on my return, but unfortunately they died, and decomposition ensued to the extent of destroying their characteristic features, before they were determined. They were, apparently, of three species.

In the month of February following, diligent search, at my request, was made for additional examples, but only one individual could be found. This proved to be the gray-spotted Triton—*Triton porphyriticus* (Green) of Dekay,—the *Gyrinophila porphyriticus* of Cope's *Check List of North America Batrachia and Reptilia*.<sup>4</sup> Its range is from New York to Alabama (Cope).

### CRUSTACEANS.

Two examples of the craw-fish, *Cambarus Bartonii* (Fabr.), were among the collections.† This species is probably the most common of our Northern forms, in ponds, creeks and rivers, beneath stones, or burrowing into banks. It extends southward into Maryland and Kentucky.

The shrimp, *Gammarus fasciatus* Say, previously noticed, was very abundant among the mosses and the water plants.

In the aquarium to which the water of the can containing the collections, was transferred, numerous examples of the minute crustacean, *Cyclops*——? were observed, resting against the glass sides, or darting swiftly through the water, very many of the females bearing on each side of them, the ovoid sac of eggs, which forms so conspicuous a feature in their appearance during this period of their existence.‡

These small crustaceans are often spoken of as water-fleas. They occur in both fresh water and salt—in the latter so abundantly that, notwithstanding their insignificant size, they constitute, it is said, a material portion of the food of whales.

### INSECTS.

#### COLEOPTERA.

The following species of water beetles were obtained from the plants at the time of their collection, or subsequently from the aquarium in which they were placed on my return to Albany:

\* Bulletin of the United States National Museum. No. 1. 1875.

† Prof. Uhler finds these examples representative of the Northern type, but to differ, in details of mouth-organs and proportions of body, from the Montana forms.

‡ For an outline figure of *Cyclops quadricornis*, see American Naturalist, vol. ix, p. 586.

<i>Laccophilus maculosus</i> Germ.....	Trans. Am. Ent. Soc., IV, p. 399.
<i>Acilius semisulcatus</i> Aubé.....	Ib. p. 401.
<i>Hydriyporus? oppositus</i> Say.....	Ib. p. 393.
<i>Hydroporus affinis</i> Say.....	Ib. p. 391.
<i>Dytiscus Harrisii</i> Kirby.....	Ib. p. 407.
<i>Laccobius agilis</i> Randell.....	Bost. Journ. Nat. Sci., II, p. 19.
<i>Philhydrus nebulosus</i> Say.....	Trans. Am. Ent. Soc., II, p. 250.
<i>Philhydrus reflectipennis</i> Zimm.....	Trans. Am. Ent. Soc., II, p. 250.
<i>Hydrobius subcupreus</i> (Say).....	Journ. Acad. N. S. Ph., V, p. 189.
<i>Hydrobius despectus</i> Lec.....	New Sp. N. A. Coleop., p. 25.
<i>Hydrobius globosus</i> Say.....	Long's Expedition, II, p. 276.

They are all strictly aquatic species, belonging to the families of *Dytiscidæ* (the first five mentioned) and *Hydrophilidæ* (the last six). For their determination, I am indebted to the kind services of Dr. Le Conte, of Philadelphia.

The *Dytiscidæ* have an extensive distribution, being found in all quarters of the globe. The peculiar structure of their posterior and middle pair of legs, which are flattened and edged with a row of dense cilia, permit of their swimming with great agility, readily ascending to the surface of the water for air, and again diving to the bottom (whence the derivation of their name, meaning a diver), with the greatest ease. In swimming, their hind legs move together, like those of a frog, and by observing this motion, they may be distinguished from the *Hydrophilidæ*, in which they act alternately. They are carnivorous in their habits in both their larval and perfect states, like the mature forms of the predaceous land-beetles—the *Carabidæ*, which they closely resemble in structure, except in their legs. Occasionally they leave the water, climbing up the stem of a water-plant in the evening, whence they take wing, rising almost perpendicularly in the air, and dropping after their flight upon the surface of water, and at times upon sashes of glass, as glazed garden frames, etc., which they mistake for water. Their locomotion on land is quite limited, from their hind legs being capable only of a horizontal movement. The species of *Laccophilus*, however, are able to spring a considerable distance. The hybernation of many of the species is beneath moss and lichens, from which they occasionally venture forth, being sometimes seen swimming under the ice; others maintain a torpid state, buried in the mud.

In illustration of this family, two of the species mentioned above as occurring in Caledonia creek, are figured, viz., *Dytiscus Harrisii* Kirby (fig. 2, plate 4), one of the largest of our species, and of common occurrence, and *Acilius semisulcatus* (fig. 7, plate 4), a more unusual form. Figure 1, plate 4, represents a larva belonging to this family, believed by Dr. Le Conte, from an inspection of the original drawing, to belong to the genus *Gaurodytes*. Several examples of it occurred in the Caledonia collections.

The larvæ of these beetles have been called water-tigers, from their predaceous habits. They are long, cylindrical, usually with contracted necks, and a flat head, armed with powerful jaws, which they use expertly in seizing and devouring other insects. Comparatively few of the larvæ of our species are known. The larva of *Acilius semisulcatus* may be presumed to resemble that of the European *A. sulcatus*, shown in fig. 4, plate 4, from an outline figure by Westwood. Of this larva, it is said: "It is extremely insidious in its attacks; the downward bending of its neck, and the upward turning of its head, inducing it to seize objects above rather than in front of it; so that when an object is perceived floating on the surface of the water, the larva rises very cautiously until it has nearly reached it, when, by a sudden jerk of the neck, it seizes the

object with its jaws, and immediately drags it under water; if it still struggles, the larva endeavors to despatch it by repeated jerkings of the head. When in the water they may constantly be seen jerking themselves in every direction, probably for the purpose of seizing upon other minute insects." (Westwood, loc. cit., I, p. 102.)

Another species of this genus — *Acilius mediatulus* of Say — will probably be found at Caledonia, as it is quite a common species.

Of the genus *Hydroporus*, of which two species were taken at Caledonia, seventy-seven species are described from the United States.\* The individuals of the several species are also usually quite abundant.

The family of *Hydrophilidæ* is named from the principal genus, *Hydrophilus* — the name from the Greek, meaning a lover of water. The larvæ are predaceous, eagerly catching and devouring other insects. In their perfect form, as beetles, they live almost wholly on vegetable food, and are, therefore, valuable agents in the purification of our waters, from their feeding on refuse and decaying vegetable matter. Their legs are similar to those of the preceding family, but they do not swim with the same facility.

An interesting feature of some of the species of *Hydrophilidæ* is the cocoon-like envelop which the female spins for her eggs—fifty or sixty in number. It is composed of silk, proceeding from two large silk glands, like those of many of the Lepidoptera, through a pair of external spinnarets. The cocoon has been compared in shape with a turnip, having a horny projection which serves as a respiratory channel for the young larvæ after they are hatched. In some species, the cocoon is attached to aquatic plants, and in others it is borne about by the beetle, upon the under surface of the abdomen. In fig. 5, plate 4, the form of the cocoon or egg-envelop of *Hydrophilus piceus* Linn., a European species, is shown: figure 6 is the same cut open to show the arrangement of the eggs contained within. The figures are copied from drawings by Riley, given in *Le Baron's Fourth Annual Report on the Insects of Illinois*.

*Hydrophilus triangularis* Say — one of our common species and of frequent occurrence in ponds, is represented in figure 9, of plate 4, in illustration of this family. The figure is from the same source as above cited.

While all the species of these two families, in both their larval and perfect stages, furnish desirable food for fishes, it is proper to state that many of their larvæ also prey upon very young fishes. It is not probable, however, that in pisciculture serious evil need be apprehended from the presence, unless in very unusual number, of predaceous larvæ. From the rule of general antagonism prevailing throughout nature—of devouring and being devoured in turn—final good undoubtedly results, in the succumbing of the weaker forms, and the survival of those best fitted to accomplish the objects of their creation.

#### DIPTERA.

The larvæ of two species of small flies, allied to the musquitos and gnats, were abundant in the plants collected at Caledonia in March, 1877, and very abundant in a package containing additional material, from the same source, received in February, 1878. They are, to all appearance, congeneric with the larvæ figured by Packard, Smith, Glover and others, as those of *Chironomus*.

The perfect insects of this genus are mosquito-like in appearance, having beautifully feathered, usually triangular, antennæ, a large thorax, small abdomen and wings, and long, delicate legs. A large number of North American species are embraced in the genus, so that it would not be proper, with our

\*Crotch: Revision of the Dytiscidæ of the United States. Trans. Amer. Ent. Soc., iv, p. 383.

present knowledge, and without observing the transformations, to make a specific reference to any of the larvæ. A species is described by Dr. Fitch, in his *Winter Insects of Eastern New York* as *Chironomus nivoriundus*—the snow-born midge.\* It is said of it: "It is a very common species, appearing upon the snow in the winter season, and upon fences, windows, etc., in the forepart of spring, the males and the females being about equally numerous. The beautiful plumose antennæ of the former distinguish them at a glance from all other insects abroad at this season. At times they may be met with in immense swarms. April 27, 1846, in a forest, for the distance of a quarter of a mile, they appeared in such countless myriads as to prove no small annoyance to the passer, getting into his mouth, nostrils and ears at every step, and literally covering his clothing. These had probably hatched from the marshy border of an adjoining lake." On one occasion, a species of *Chironomus*, believed by Walsh to have been the *stigmaterus* of Say, appeared in such a swarm, on Long Island, as to have been mistaken by the observer for smoke coming from a hay-stack half a mile distant.†

One of the two forms of the larvæ above mentioned, represented in fig. 13 of plate 4, was so numerous in the package of *Chara vulgaris*—a very common plant in a large pond near the hatching-house—that, on taking up little patches of it from the bottom of the box in which it was packed, they would be found almost covered with the larvæ. They evidently had a fondness for the fishes which had died in the *Chara* while in transit, for from the body of a small *Cottus* twenty individuals were removed, and nearly as many from a quite small *Gasterosteus*. The abundance of this form, associated with a plant simply taken from the water for the purpose of packing, would indicate an exceedingly prolific species, and also the possibility that it might be the form which originates the "immense swarms" of *Chironomus nivoriundus*, like that observed by Dr. Fitch.

The other species of larva, much less abundant, was more elongate, with longer joints proportionately, and of a blood-red color. It is also, by writers, referred to the genus *Chironomus*.

The fly captured upon the wing (before mentioned) has been referred by Mr. Burgess, of the Böst. Soc. Nat. Hist., who is paying special study to our Diptera, to the family of *Ephydriidae*, and probably to the genus of *Scatella*; but, in the absence of its antennæ, it cannot be positively placed. Most of the larvæ of this family are aquatic, and many of them possess particular interest, from their occurrence in the graduating houses of salt-works, and very numerous in some of the western salt lakes.

The tribe of Ephydrina, to which *Scatella* belongs, have, as a prominent characteristic feature, naked eyes. On submitting the above example to a high magnifying power, traces of hairs are discoverable, from which it is almost evident that the hairy clothing of the eyes has been removed through the extremely rough handling which I had unfortunately given the insect. If this should prove correct, then it is not improbable that the species should be referred to the closely allied *Hydrellina*, and perhaps to the genus *Hydrillia*, near to *H. hypoleuca* Loew.‡ In that species, the first joint of the hind tarsi is red; in the Caledonia example, black.

#### HEMIPTERA.

Examples of *Gerris remiges* Say—shown in fig. 10, plate 4, were found abundantly, skipping over the surface of some quiet water. These insects,

\* American Journal of Agriculture and Science. Vol. v, p. 282. 1846.

† The Practical Entomologist. Vol. ii, p. 10. 1866-67.

‡ Monographs of the Diptera of North America, by H. Loew. Part I, p. 151. 1862.



from their six long legs branching out from their small bodies, and their peculiar motion, in jerking over the surface of the water of ponds and the more quiet portions of our streams, are familiar to all. The popular name of water-boatmen is sometimes applied to them. They are extremely active creatures, skimming about with great velocity, and quickly turning in any direction. Westwood states that their hind feet act conjointly as a rudder, while the longer middle feet, placed at the middle of the sides of the body, are used somewhat as oars; they are not, however, dipped into, but merely brush along, the surface of the water. With their shorter fore-legs they seize and hold the small insects upon which they prey, while devouring them. The under-side of the body is covered with a plush-like coating to repel the water.

They belong to the family of *Hydrometridæ*, and are placed by Latreille in the section of *Ploteræ*—not very appropriately named, as Westwood remarks, for their motion is not that of swimming. For a long time the generic name of *Gerris* has been applied to them, but they have been recently referred to new genera by Stal. Professor Glover\* cites six species, viz.; *G. canaliculatus* Say (Georgia), *G. conformis* Uhler (Md.), *G. lacustris* Fabr. (Md.), *G. marginata* Say (U. S.), *G. remiges* Say (U. S. generally), and *G. rufoscutellata* Latr. (U. S.). The last three species have a broad distribution, they having been collected by Prof. Uhler and Dr. Packard, in Colorado.† Of *G. remiges*, Prof. Uhler writes, loc. cit.: "Collected by Dr. Packard, on July 10, in Denver; at Boulder, June 20; and at Manitou, July 15. It was found, also, by myself on the still water along the margins of Sloan's lake, and it was very abundant also on the surface of the irrigating canal proceeding from the cañon of the Arkansas, in August." Prof. Uhler, to whom I owe the authoritative determination of this species, refers it to the genus *Hygrotrechus* of Stal.

Numerous examples of another form of "water boatman," of the family of *Notonectidæ*, and of the genus *Corixa*, were contained in the box of *Chara* received from Caledonia in February. They are apparently of two species—the larger measuring three-eighths of an inch in length of abdomen, and the smaller about one-half so long. They were submitted to Prof. Uhler, who informs me that "the species does conform to any published description, and is, therefore, probably undescribed." From an accompanying pen-and-ink sketch, the larger form shown in fig. 11 of plate 4, is undoubtedly the one referred to, the smaller one having probably escaped from the box in which they were sent alive.

Large companies of these insects are often seen floating on the surface of the water, frequently with their back downward. When disturbed, they dive to the bottom with a quick, paddling motion. Their hind legs have the two tarsal joints very long, broad, and fringed with cilia, admirably adapting them for swimming purposes. The fore-legs are partly prehensile, armed with a single claw—these legs not seen when at rest. The middle legs are comparatively slight, terminating in a long and slender claw; when floating on the surface, these are bent backward, while the hinder legs are thrown forward as balancers, as shown in the figure, apparently reversing their true position.

A species of this genus, *C. mercenaria* Say, is said, by Say, to be largely used in Mexico as food.

In figure 8 of plate 4, the family of *Belostomidæ* is represented, in *Belostomatæ Americæ* Leidy; the specimen figured is not of the maximum size. The largest of the Caledonia examples measured two and a quarter inches in length of

\* Manuscript Notes from my Journal. Order Hemiptera. By Townsend Glover, p. 39. 1876.

† Bulletin of the U. S. Geolog. and Geograph. Survey of the Terr. Vol. iii, No. 2, p. 453. 1877.

abdomen, while in the *Practical Entomologist*, vol. i, p. 249, a figure of the species is given (erroneously referred to the South American *B. grandis*,) which measures two and one-half inches in length. Another species, the *B. grisea*, occurring in several of the seaboard States, is said to attain the length of three and a half inches.

The principal features of this insect—its strong prehensile fore-legs, its flattened body, and its broad hind legs, are well shown in the figure. It is an aquatic species, but occasionally takes flight for short distances. Its popular name is the "gigantie water-bug."

The Belostomæ are predaceous, feeding on many of the smaller aquatic insects, and on fishes and their eggs. Their presence, therefore, is to be dreaded, in waters devoted to pisciculture. Prof. Glover states (loc. cit., p. 26), that a small goldfish in the aquarium of the Department of Agriculture, at Washington, which had been left over night with a specimen of the *B. Americanum*, was found the following morning to have been killed by it.

This species occurs in Texas and throughout the Atlantic region, from Maine to Florida (Uhler).

#### NEUROPTERA.

*Perlida*.—One of the two species of Neuroptera, previously referred to, (page 77) as having been captured on the wing at Caledonia, on the first of December, is a species of *Leuctra*, and, as I am informed by Dr. Hagen, to whom it was submitted, probably undescribed. Of the two known North American species, viz., *L. ferruginea* and *L. tenuis*, it is nearer to the latter, and possibly more abundant material (only two examples were taken) and in better condition, might show it to be identical. Dr. Fitch, in his *Winter Insects*, (loc. cit.) describes two other species, as *Perla nivicola* and *Nemoura nivalis*, which are different from this species. In remarking upon the abundance of the two forms, Dr. Fitch says: "One of the purposes served by these prolific insects in the economy of nature, doubtless is, to supply with food the fish of our streams at this early period of the year" (in the latter half of winter, upon the snow).

*Ephemerida*.—The third species captured on the wing (see page 77) was in so broken a condition when received by Dr. Hagen, having lost its legs and other appendages, that it could only be referred with doubt to the genus *Baëtis*, not far from *B. alternata* Say. It might possibly belong to the genus *Potamanthus*. From its being in the subimago state, determination was rendered more difficult.

*Odonata*.—The pupal skin of a large species of dragon-fly was picked up among the dried grasses on the bank of the stream, which Dr. Hagen, from his extensive acquaintance with these forms in their several stages, is able to refer to *Anax Junius* of Drury. The imago measures four and a half inches in expanse of wings, is of a green color, spotted with blue and fuscous, and with a yellow head. Its larva is correspondingly large and powerful, and from the known habit of most of the Odonata, must be particularly injurious to the culture of fishes. This species has a remarkable distribution, extending across the entire continent from New York to San Francisco, and southwardly into Texas, Mexico and Cuba. It occurs also in the Sandwich Islands, Kamtschatka and China (Hagen).

In the later February collections, there were contained several living pupæ of *Æschna verticalis* Hagen, shown in figure 10 of plate 5. This is a smaller species than the above, having an expanse of wings of but three and three-fourth inches. Its only assigned habitats are New York State and Washington, D. C.

The above family will undoubtedly be found very largely represented at Caledonia—usually abounding in and about waters which have an abundant insect fauna. It is quite desirable that full collections of them should be made during the season when they occur most numerous—in the months of July and August. In their larval and pupal forms, they are the terror of the inhabitants of the water, and in their perfect form, they are the hawks and eagles of the insect world, persistently chasing and devouring other smaller insects. Their habits, in all their stages, are exceedingly interesting, but it would occupy too much space to present them here.

*Phryganidæ*.—The second species, before referred to, of which many individuals were observed at Caledonia, alighting after short flights on the whitened, dead Chara, strewing the shore of a pond, is *Chilostigma coagulata* Say MS.—the name in Say's handwriting being attached to a specimen in the Harris Collection at Boston. It is mentioned in Hitchcock's Report, 2d edition, p. 582, and by Dr. Hagen in *Proc. Bost. Soc. Nat. Hist.*, vol. xv, p. 296, as *Platyphylas coagulata*. Dr. Hagen writes me farther in relation to it: "The genus *Chilostigma* was established by McLachlan, in 1876, for a European species, *C. Sieboldii*, which is nearly related to *C. coagulata*, differing by characters which are probably only of specific value, viz.: the apical joint of the labial palpi in the North American species, is egg-shaped; the length of the joints of the maxillary palpi of the female is slightly different in their proportions, and the areolus in the interior wings is straight and unbroken. I would not deem it advisable, for the present, to establish a new genus for the N. A. species, of which three are described by Walker, as *Limnephilus*, and in the *Synopsis of North American Neuroptera* as *Enoicyla*, because all have 1, 2, 2, spurs. The species are:

"1. *C. coagulata* Say. Dublin and Mt. Monadnox, N. H.

"2. *C. difficilis* Walk. Mt. Monadnox, N. H. This species are much like the first, but a little larger, and the male and female have different genital parts.

"3. *C. præterita* Walk. Arctic America, Slave River.

"4. *C. interseisa* Walk.=*Phr. irrorata* Fabr. (teste McLach.). Hudson's Bay Territory. This species differs from the others by much more elongate wings.

"*Chilostigma* is a northern, probably an Arctic genus. The species are nearly the latest Neuroptera in their appearance in their imago state. Their nymphæ swim in the water in undergoing their last metamorphosis, when they fall an easy prey to fishes."

As *C. coagulata* has not, to the present, been described, a figure enlarged to two diameters, is given of it. (Fig. 2, plate 5.)

The *Phryganidæ*, in many of their species, bear so strong a resemblance to some of the moths of the Order of Lepidoptera, in the shape of their wings and in the hairs with which they are overspread, that they are sometimes designated by the name of water-moths. In their larval stage, passed in the water, they are known as case-worms, or caddis-worms. They live in cases, which, by the aid of a silk which they spin, they build about themselves, composed of various substances, such as portions of leaves or stems of plants, pieces of wood or bark, the shells of the smaller species of *Helix*, *Planorbis*, *Limnæa*, etc., gravel, fragments of stone, seeds of plants, and of almost any small body which may occur in their locality.\*

\*In two examples contained in the material recently received by me from Caledonia, the larvæ, which were of large size, with the object no doubt of avoiding the labor attending the construction of a new case, necessitated by their growth, had availed themselves of the hollow stem of some sileceous-coated aquatic plant of a suitable diameter (one-fourth inch), a section of which two inches in length, afforded them a strong, agreeable, and easily transported habitation.

These cases are of various forms and proportions, sometimes being of an oval shape, and attached by the rim to the under surface of a stone, but more generally of an elongated, cylindrical form. These latter are closed at one end, with the other remaining open to admit of the extrusion of the head and thoracic segments of the larva, for the purpose of locomotion or taking its food. It retains its position within the case by means of some hooks at its posterior extremity, and three mammiform protuberances on its first abdominal segment (shown in fig. 9, plate 5), adhering so strongly that considerable force is required for its dislodgment.

Sub-fam. *Rhyacophilidæ*.—In fig. 1, plate 5, one of the oviform, attached cases, above referred to, and quite common at Caledonia, is represented. They are usually considerably longer than broad, as I recall them in place—the examples at hand having evidently been distorted in their careless removal from the stone. They belong, as Dr. Hagen informs me, “to the sub-family of *Rhyacophilidæ*. There are only eight North American species described, but a number of others are known. From the small size of the examples sent, they probably do not belong to *Rhyacophila* proper, but to some other genus yet to be established. The cases of these larvæ are composed of pieces of stone, or other rough material, and are attached to the surface of stones. The larva is not confined to its case, but passes in and out of it through an aperture. Most of the species of *Rhyacophila* build for the nymph, a brown, membranaceous cocoon, which is wanting in these examples.”

Westwood, loc. cit., vol. ii, p. 62, fig. 68.6, represents a case somewhat similar to this, but more elongate, and composed of finer material, which he refers to *Hydropsyche senex* Pictet. He says of the larvæ: “They are compelled to quit their retreat whilst searching for food, in a naked state, and they are accordingly better fitted for such a kind of life, by having the abdomen of a firmer consistence. Their pupæ are inclosed in a single silky envelop, to which various materials are attached.”

*Hydroptilæ*.—In fig. 4, plate 5, a case of one of the *Hydroptilæ* (natural size), is shown. Dr. Hagen writes of it: “It is probably of the genus *Phriaocoma* Eaton. Of the *Hydroptilæ* cases very little is known. I have worked much at them, but have not yet published. The shape and manner of living are similar for all, but some cases consist only of silk and fibres of *Chara*, very neatly arranged. A full account of one is given in the *London Quarterly Journal of the Microscopical Society*, 1857, New Series, Vol. VII, No. xxv, p. 83; and we have found a similar one here.”

Westwood (loc. cit.), fig. 68.5, figures the case of the European *Hydroptila pulchricornis* Pictet—“a small, flattened, kidney-shaped case, opened by a slit at each end.” These cases resemble somewhat the interior cases of *Rhyacophila*, but differ from them in their not being inclosed in an additional outer case, and in their swimming freely in the water.

Sub-fam. *Sericostomidæ*.—The cases constructed by the larvæ of this group are represented in fig. 5, plate 5, given in twice the natural size. They are sub-cylindrical, being somewhat flattened, and usually larger at their open end. They are composed of grains of sand, bits of stone, or other hard material, and occasionally a small shell is worked in. Often a larger stone is attached to each side, as shown in the figure, to give them, it is supposed, additional weight. But few of the species have been described. Dr. Hagen refers the species here-with figured to *Silo*, or some nearly related genus. Quite a number of these cases, when collected, were slightly fastened at one extremity to stones, indicating the readiness of the occupants for their pupal change, or in the examples where the cases were closed, their having already entered upon that stage. In their early state, they are numbered among the unattached forms, moving freely in the water.

Sub-fam. *Lamnophilulæ*.—An interesting case of this group is shown in fig. 8, plate 5. It consists mainly of pieces of charcoal interspersed with sand, fragments of stone, seeds of a raspberry, a number of the shells of *Planorbis* (*Gyraulus*) *parrus* Say, and a few valves of a species of *Sphaerium*. It obviously belongs to a genus near to *Hallesus*, and may possibly pertain to the *Chilostigma coagulata*, shown in fig. 2, plate 5.

Another of the same group is given in fig. 3, plate 5. From the entirely different material of which it is constructed, as well as the manner of its construction, it is probably of a different species, and perhaps of a different genus, but not far removed from *Hallesus*. It is composed principally of small pieces of stone and marl, with here and there a minute shell and a hard seed. Before its open end was closed with its silken grating the larva, as an additional protection, had attached to it a stone, nearly covering and projecting over it at an angle of 60°; the angle is not represented in the figure.

Fig. 9, plate 5, represents a Phryganid larval form, of which hundreds of examples were found in the box of *Chara*, much the larger number being without cases, although similar in appearance to other encased ones. The vacant cases observed seemed by far too few to have accommodated the large number of naked forms present. Many of these latter were placed in the aquarium, but nearly all were found to be dead the following day, either from injuries sustained from the Mollusca, or from an unsuitable condition of the water.

It will readily be seen that, in an aquatic form, in which the size of the abdomen is so disproportionate to the locomotive organs, some protection, like that afforded by a case, is indispensable to prevent its extermination by its natural enemies. Even when wholly withdrawn within its retreat, as is its condition under the slightest alarm, it is not exempt from attack and destruction. Some of the species of water snails as *Limnæa* and others, have been seen to attach themselves to the Phryganid cases, penetrate the walls, and devour the insects within, wholly powerless to defend themselves against this artful approach. This procedure has been observed by Dr. Hagen, who, on one occasion, in this manner, lost nearly the entire brood of a rare species which he was rearing in an aquarium in which *Limnæa* and allied forms were present.

When ready for their pupal change, these tubular-cased *Phryganidæ* partially close the opening to their dwelling by spinning across it a silken network, excluding enemies, but permitting the entrance of water. The meshes are severed as the final transformation approaches, when the insect comes to the surface of the water, and from its case, or the stem of a water-plant on which it has climbed, it withdraws itself, expands its wings, and betakes itself to its new element.

## VERMES.

Quite a number of earth worms were observed in jars to which some of the mosses had been transferred. As they were not noticed at first, it is believed that they were developed from ova. Their rapid increase in size was a matter of no little surprise.

A leech, brought from the stream, is at present lurking among the mosses of the aquarium, having, since its first discovery, been successful in eluding recapture. From the glimpses had of it, it is probably the common blood-sucking species of the Northern States, the *Macrobdella decora* (Say).\*

The leeches, as a class, are not of service to the fish-culturist. Some of the species have been found in the stomach of the lake white-fish (*Coregonus albus*

\* In a can received from Caledonia, while these pages are passing through the press (August), in answer to a request for shrimps only, at least forty specimens of leeches, of two species, were contained in the accompanying water plants.

Lesu.), but the larger number are injurious to fishes, in attaching themselves to them and sucking their blood; in being, by nature, parasitic upon them, and by destroying insect larvæ and mollusks which constitute so large a proportion of fish food. They at times occur in almost incredible numbers, as related by J. W. Milner,\* when, on one occasion, in the month of April, as some fishermen were lifting their nets from about fifty fathoms, some fifteen miles out from Kenosha, Wis., a species of *Ichthyobdella* [? *Milneri* of Verrill] so thickly covered the fishes (trout, white-fish and cisco) and the nets, that they fell to the deck in such numbers that it became slippery, and an old coat was thrown down for the man to stand upon who was lifting the gang.

### ! MOLLUSCA.

No special effort was made to collect the Mollusca of the waters. Two species, *Physa heterostrophæ* and *Limnæa desidiosa* were observed abundantly on sticks and pieces of timber in the water. In the bed of a small stream near the hatching-house, where the current was interrupted by scattered blocks of stone, a marl-like deposit occurred, consisting almost entirely of small shells and comminuted larger ones, into which the hand could be thrust to the depth of several inches. Specimens of this deposit were brought with me, and its examination disclosed the following species—authoritatively determined by Dr. James Lewis, of Mohawk, N. Y.:

*Helodiscus lineatus* Say,

*Helix albolabris* Say,

*Helix alternata* Say,

*Pupa corticaria* Say,

*Succinea ovalis* Gould,

*Zonites nitidus* Müller.

*Zonites arborea* Say,

*Carychium exiguum* Say,

*Limnæa catoscopium* Say,

*Limnæa desidiosa* Say,

*Limnæa humilis* Say,

*Physa heterostrophæ* Say,

*Gyraulus parvus* Say,

*Bythinella obtusa* Lea,

*Sphaerium* — sp. ?

*Pisidium abditum* Hald.

None of the above species are of special rarity, but are such as occur in various limestone regions throughout the State.

The *Physa heterostrophæ* and *Limnæa desidiosa*, which were taken from the waters in their living state, were brought to Albany and placed in a small aquarium. From that time (early in December) to the present, clusters of eggs have been deposited on the surface of some thin pieces of wood floating on the water, and occasionally on the glass sides of the aquarium just at the surface of the water. From these eggs, many hundreds of young have been produced, during the past three months. The clusters, which are believed to be of both species, are transparent, gelatinous masses of about one-half of an inch long, with a breadth of from one-third to one-half their length, enveloping the transparent eggs, which show distinctly, at first, the milk-white interior nucleus.

Having, in the preceding pages, referred to the various forms of animal life populating the waters of Caledonia creek, and, in addition, presented brief statements of their appearance, habits, transformations and classification, to aid in their recognition, and with a view of lending additional interest to their study, it may be proper to devote a few pages to a consideration of the economic value of the several classes in their connection with fish-culture.

### CRUSTACEANS AS FOOD FOR FISHES.

It is almost unnecessary to state the fact that the appearance, condition and quality of fish are greatly influenced by the nature of their food. One of your

\* Report U. S. Commission of Fish and Fisheries, 1872-73, p. 64.

board writes: "It is a well-known fact among fish-culturists, that the growth, flavor and color of trout are largely affected by the food which they obtain. To merely state the two extremes, trout fattened for market on liver are almost worthless for the table, while those that visit the salt water, and obtain shrimp and other similar food, are nearly equal to salmon."

Visitors to the State Hatching-house, at Caledonia, who happen to be ignorant or forgetful of this close connection between food and quality, as they make the tour of the grounds, and feast their eyes upon the rare sight presented in the thirty spacious preserves, each swarming with its hundreds or thousands of brook trout, California salmon and salmon trout (some of the last, two feet in length and ten pounds in weight), would naturally picture the table of those engaged in the culture and care of those creatures as constantly supplied from so desirable and convenient a source. They are surprised to learn that none of these fish are ever placed upon the table, the flavor of their flesh being but a few degrees removed from that of the liver on which they are fed.

In reference to the influence of the food of fishes upon their color, Mr. Charles Lanman states: "One principal cause for the great variety in the color of the brook trout, is the difference of food; such as live upon fresh-water shrimps and other crustacea are the brightest; those which feed upon May-flies and other common aquatic insects are the next; and those which feed upon worms are the dullest of all. \* \* \* Trout that frequent clear and cold waters, and feed much on larvæ [Phryganid] and their cases, are not only red in flesh, but they become golden in hue, and the red spots increase and outnumber the black ones. \* \* \* The peculiarity of feeding on shell-fish produced the gillaroo trout, a remarkable variety, found only in the Irish lakes."

According to a statement of Professor Agassiz, "the most beautiful salmon trout are found in waters which abound in Crustacea, direct experiments having shown that the intensity of the red colors of their flesh depends upon the quantity of *Gammaridæ* which they have devoured.

The improvement capable of being made to the natural flavor of fish seems to have been known to the Romans, for it is said of them: "The art of breeding and fattening fish was well known to the luxurious Romans, and many stories are related about the fanciful flavors which were imparted to such pet fishes as were chosen for the sumptuous banquets of Lucullus, Sergius Orata, and others."

The fondness and even preference, shown by many of our fishes for crustacean food, is well established. Prof. Verrill, in his *Report upon the Invertebrate Animals of Vineyard Sound*,\* says: "These small crustacea [Amphipods] are of great importance in connection with our fisheries, for we have found that they, together with the shrimps, constitute a very large part of the food of our more valuable, edible fishes, both of fresh and salt waters. \* \* \* Even the smallest of them are by no means despised or overlooked, even by large and powerful fishes, that could easily capture larger game. Even the voracious blue-fish will feed upon these small crustaceans, where they can be easily obtained, even when menhaden and other fishes are plenty in the same locality. They are also the favorite food of trout, lake white-fish, shad, etc."

Crustaceans constitute almost the entire food of the herring (*Clupea* species), a fish which, from its number and large consumption, is of so much value in the fisheries of both hemispheres. According to a theory recently advanced by Sars, the migrations of the herring, for a long time unexplained, are controlled by the presence of their crustacean food. He affirms that a rich summer herring fishery depends exclusively on the accidental occurrence of small crusta-

\* U. S. Commission of Fish and Fisheries. Report for 1871-72, pp. 295-778, plates 38.



ceans, and their accidental accumulation in certain places favorable to the fisheries. During some years, the sea, near the western coast of Norway, throughout the whole summer, has been filled with great masses of different crustaceans. At such time the fishermen expect to be favored with the presence on their coast of the "herring-mountain"—a high, deep, and closely-packed mass of herrings.

The shad (*Alosa sapidissima*) eagerly devours crustaceans when they can be obtained. During their presence in our rivers for the purpose of spawning, they partake of no food. A microscopic examination of the stomachs of twenty shad (*Alosa vulgaris* of Europe), made at their advent into fresh water, revealed the tarsi, antennæ, etc., of microscopic Entomostraceans and other small crustaceans. Nothing else could be recognized.

The white-fish (*Coregonus albus*) was for a long time believed to feed on algæ and aquatic plants; but it was ascertained by Dr. Hoy, of Racine, Wis., through a careful examination of the partially digested contents of their stomachs, that they fed mainly on a small crustacean, whose presence in the lake had not been suspected.\*

Similar examinations, instituted by Mr. J. W. Milner, of the stomachs of white-fish from various localities in Lake Michigan, confirmed the statement of Dr. Hoy, that the Crustacea constituted by far the larger proportion of their food, namely, species of the *Gammaridæ* and *Mysidæ*. Associated with these were Molluscan species of *Pisidium* and other genera, together with Phryganid insects. At Sault Sainte Marie the white-fish has been taken with a hook baited with a May-fly.

The favorite food of the black bass (*Micropterus nigricans*) is the craw-fish—species of *Cambarus* and *Astacus*, when they can be procured.

The lake-herring (*Argyrosomus clupeiformis*) feeds upon the *Gammaridæ* and insects.

Mr. Seth Green informs me, that it is believed that the peculiar richness of the Otsego lake bass (*Coregonus ?Otsego*)—its superiority over that of the white-fish of the lakes, of which it is thought, by many, to be but a local variety, is the result of its feeding largely on a small crustacean, which is remarkably abundant in Otsego lake.

The food of the salmon (*Salmo salar*), previous to its entering fresh water for spawning, during which period, like the shad, it partakes of no food, consists principally of Crustacea, "this rich aliment giving the color and flavor for which its flesh is so highly prized."

The American smelt (*Osmerus mordax*)—one of the salmon family—feeds largely on the shrimp. They are readily taken with a hook, baited with any of the smaller crustaceans, or pieces of the larger species.

Nearly all our salt-water fishes feed upon crustaceans, from the minute *Entomostraca* to the large crabs and lobster. Prof. Verrill, loc. cit., pp. 514-521, gives a list of thirty-two species, in the stomachs of which crustaceans, as the principal portion of their food, were found.

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\* *Mysis relicta* Loven. The detection of this species in the waters of lakes Michigan and Superior was a very interesting discovery, not only from its first having been brought to notice in this country, in the stomach of a white-fish, but also from its identity with the species previously known as existing, under similar conditions, in the fresh-water lakes of Sweden and Norway. Dr. Sars had found it in Wener and Wetter, and eight other lakes in Sweden, and in one lake in Norway. Dr. S. regards it as specifically identical with the salt-water form occurring off the coasts of Labrador and Greenland—*Mysis oculata*; the varietal differences which he finds, he regards as resulting from the interruption of its former salt-water communication. He accordingly designates it as *M. oculata*, var. *relicta*.—(Smith's *Fresh-water Crustacea of the United States*; U. S. Comm. of Fish and Fisheries, pt. ii, for 1872-73.)



It can scarcely fail of being observed, from the above statements, that nearly all the fishes which are most highly prized for richness and delicacy of flavor—the shad, the salmon, the trout, the white-fish, and the Otsego lake bass—are those whose diet is, to a great extent, crustacean. Hence, the inference is a natural one, that the Crustacea are the best food upon which fishes can feed.

## INSECTS AS FOOD FOR FISHES.

Insects, in either their larval or perfect stages, form a portion of the food of nearly all our fresh-water fishes, and a very large proportion of the food of most of the species.

Sir Humphry Davy remarks: "As a great proportion of the insects that fly, walk, or crawl, are the food of fishes, a dissertation or discourse on this subject would be almost a general view of natural history."\*

The art of fly-fishing, which has given to our libraries the delightful volumes of Walton, Davy, and others, and contributed so many hours of unalloyed happiness to the angler and the naturalist, is an enduring attestation to the love of fishes for insect food.

The trout is preëminently an insect-loving fish. The facility with which it is enticed by the artificial fly is known to all, and its leaps from the water to capture the insect floating on the surface or winging its way above it,† are familiar to those who have had the privilege of making its acquaintance in the more secluded lakes and streams of the Adirondack wilderness. The range and extent of its insect diet may be best shown by some extracts from a paper on "*The food of the Salmon, the Trout, and the Shad*," prepared by D. Barfuth, of the University of Bonn.‡

An examination of the digestive organs (from the œsophagus to the anus) of twenty-one specimens of the common trout of Europe (*Salmo fario*) obtained, November 25, 1873, gave as follows:

1. Twenty-one wings of insects—mostly Neuroptera.
2. Twenty-six parts of integuments, heads and wings of Coleoptera and Orthoptera, as well as Crustaceans and Myriopods.
3. Thirty-five tarsi and other portions of the legs of the same insects.
4. Thirty-six larvæ of *Phryganidæ* and their cases composed of particles of quartz and plants.

No remains of fish were discovered. In some stomachs, the tolerably well-preserved larvæ of *Sialis lutaria* were found. On one occasion I found six cases of *Phryganidæ* in a fish, and several times three or four were packed closely together, so that they extended the stomach, and could be seen from the outside. In some instances the larvæ of these cases were well preserved."

A later examination (20th June, 1874), of the stomachs and entrails of six trout, caught in the Kyll, near Gerolstein, gave the following results:

"In the first, I found four cases of *Phryganidæ*; in the second, I found one hundred and thirty-six cases, one insect, one dragon-fly's wing, and the remains of a fish; in the third, five hundred and eighty-five (?) cases, one insect, and the scale of a fish; in the fourth, one hundred and sixteen cases, one insect and the

\* Salmonia and Consolation in Travel. London, 1840. Vol. ix, p. 152.

† The capture of insects upon the wing by trout has been questioned; but, in confirmation of the assertion, Mr. W. W. Hill, of Albany—a gentleman who has had much experience in fly-fishing, and with the eye of a thorough naturalist, has carefully studied the habits of the trout, makes the following statement: "From personal observation, I am able to state, that it is a *very common occurrence* for the speckled trout (*Salmo fontinalis*), during the months of June, July and August, in the Adirondack region, to spring from the water and catch moths, dragon-flies, ephemera, caddis-flies, and other insects flying near the surface."

‡ U. S. Commission of Fish and Fisheries. Part iii. Report for 1873-74 and 1874-75, p. 735.

remains of a fish; in the fifth, one hundred and eighty-six cases, and the flower of a graminaceous plant; in the sixth, one hundred and fifteen cases, a small caterpillar, a number of fish-eggs, and one-half of a small fish. The cases of *Phryganidæ* were found in all the stomachs, and also in the entrails; in one, the intestinal canal, as far as the anus, was completely stuffed with the cases."

Similar examinations of the stomachs of the brook-trout (*S. fontinalis*) made in this country have shown the presence of numerous Phryganid larvæ, with the cases of various species of both slight and strong construction.

The contents of the stomachs of some white-fish, examined by Prof. S. I. Smith, gave the following insect remains: *Chironomus* larvæ and pupæ; the imago of two species of *Diptera*; larvæ and pupæ of *Ephemeredæ*; larvæ, pupæ and subimagos of *Hydropsyche* and of another Phryganid; the legs and scales of a Lepidopterous insect.

In an excellent paper "*On the Benefit and Damage of the Trichoptera*" (a division of the Neuroptera including the *Phryganidæ*), contributed to the *Stettiner Entomologische Zeitung*, 1848, Vol. ix, pp. 50-52, by Dr. Kolenat, the writer asserts that Phryganids are a first-class food for fishes. Not only are they very desirable for food, but they are valuable also as indicating the character of the water—the nature of their cases indicating clearly the chemical composition of the water, and its adaptation to fish-culture. No pond or stream should ever be selected for pisciculture, unless the *Phryganidæ* are abundant in them.

With the above attestations to the high character of insect food for the use of fishes, and in consideration of a very prevalent belief that many insects were specially created to serve as fish-food, it will be unnecessary to multiply details, at the present, of the peculiar fondness of fishes for this diet, or of certain species for particular classes of insects. It may suffice to say, that the entomologist can corroborate the statement of Sir Humphry Davy (loc. cit., p. 159),—"there is hardly any insect that flies, including the wasp, the hornet, the bee and the butterfly, that does not become, at some time, the prey of fishes."

#### MOLLUSCA AS FOOD FOR FISHES.

The food of the Lake sturgeon, *Acipenser rubicundus* Lesu., consists almost entirely of the shell-fish of the lakes, principally Gasteropods—the thinner shelled kinds of the genera *Physa*, *Planorbis* and *Valvata*, being found broken in the stomachs, while *Limnaea* and *Melantho* remain whole (J. W. Milner). At Sand Island, Lake Superior, a specimen contained a few bones of some fish and numerous shells, among which were the following: *Valvata tricarinata*, *V. sincera*, *Limnaea catascopium*, *Physa* sp. ?, *Planorbis bicarinatus* and *Sphærium striatinum* (S. I. Smith).

The stomachs of some white-fish from Sault Sainte Marie contained scarcely anything but small shells. Among these, *Valvata tricarinata*, *V. sincera*, *Ambicula genivosa*, *A. pallida* (?), *Gyraulus parvus*, and a species of *Limnaea* were in abundance; there were fewer specimens of *Goniabasis livescens*, *Physa vinosa* (?), *Sphærium striatinum* and *Pisidium compressum* (S. I. Smith).

I have no accessible data showing the extent to which the trout, salmon trout and other of our fresh-water fishes, feed upon the Mollusca, but there is every reason to believe that they form a portion of the food of many of the species, and that the molluscan ova are readily eaten by their young.

A large number of our salt-water fishes are recorded by Prof. Verrill as feeding on Mollusca—as, for example, the porgee, black-fish, cod (twenty-six species of shells are mentioned as having been found in its stomach), haddock,

flounder, minnow, blue-shark, tiger-shark, skate, sting-ray, and the long-tailed sting-ray.

#### PLANTS AS FOOD FOR FISHES.

In Europe, the common carp (*Cyprinus carpio*) has long been cultivated, from the ease and economy with which it is reared on aquatic vegetation, and "on all vegetable and animal kitchen-refuse, agricultural products of little value, etc., which supply a wholesome food for them, if it is given to them in small pieces, so that they can easily grasp it with their toothless mouth and swallow it." Others of the carp family—the tench (*Tinca vulgaris*), the barbel (*Barbus fluviatilis*), the bream (*Abramis brama*), and the bleak (*Alburnus lucidus*), are represented as vegetable feeders.

The gourami (*Osphromenus olfari*), of Eastern Asia, famed for its excellence as food, is also largely a vegetable eater. Prof. Gill, in his "*Natural and Economical History of the Gourami*,"\* furnishes the following interesting account of its food:

"The gourami is omniverous in its appetite, taking at times fish, frogs, insects, worms, and many kinds of vegetables; it is, however, essentially a vegetarian, and its adaptation for this diet is indicated by the extremely elongate intestinal canal, which is many times folded on itself. It is said to be especially fond of the leaves of several Araceous plants belonging to the genera *Caladium*, *Arum* and *Pistia*; but it also devours, with not much inferior relish, cabbage, radish, carrot, turnips and beet-leaves, lettuce, and most of the wild plants which grow in the water, and it can secure for its use the leaves of plants that grow on the banks and a slight distance out of the water. It also takes wild rice, maize, potatoes, arrow-root, manioc, bread and analogous articles."

The attempt is being made to introduce both the carp and the gourami into this country for cultivation.

An interesting statement is given by J. Stanton Gould, in a valuable paper by him on "*The Grasses and their Culture*,"† of the fondness of the trout for the seeds of a plant—the *Glyceria fluitans*. This is a rather common plant, ranging throughout the United States, from Canada to Louisiana, and also occurring in Europe. "It is found growing in shallow water, overflowed meadows and wet woods, but will bear cultivation on moderately dry grounds. Schreber says that it is cultivated in several parts of Germany for the sake of the seeds, which form the manna-crop of the shops, and are considered a very great delicacy in soups and gruels. When ground into meal, they make bread very little inferior to that made from wheat. All granivorous birds are exceedingly fond of these seeds. \* \* \* \* \* Trout, and, indeed, most fish, are very fond of them; and wherever *G. fluitans* grows over the banks of streams, the trout are always found in great numbers waiting to catch every seed that falls."

In plate 33 (op. cit.), figs. 104–107, this interesting grass is illustrated.

In proceeding, after the above consideration of the various classes of fish-food (which I trust will not be regarded by your board as wholly digressive), to the subject to which my attention was particularly invited, we may consider, first:

\* U. S. Fish Commission—Report 1872–73, pp. 710–728.

† Trans. N. Y. State Agricul. Soc. Vol. xxix, 1869, pp. 191–402, plate 74.

## THE DESIRABILITY OF TRANSPLANTING FISH-FOOD.

If, as there is every reason to believe, the great abundance of trout in Caledonia creek is owing to two principal causes, viz.: the character of the water, and the nature of its fauna and flora, then we may draw the following conclusions:

First. In any stream having the same character of water, the addition of a similar fauna and flora should fit it for an equal abundance of trout.

Second. Streams, ponds, and lakes having a different character of water (as to current, temperature, substances in solution, etc.), by the addition of a similar fauna and flora, may be fitted for an equal abundance—perhaps greater—of some species of fish desirable for food.

It is evident that, however well adapted a body of water may be, in the conditions above referred to, and others of the kind, for a fish population, there may still be wanting the essential requisites of an appropriate and efficient food-supply.

The absence of proper food is not necessarily the consequence of unsuitable conditions of the water. There are, undoubtedly, in certain waters, conditions which are unfavorable to, perhaps inconsistent with, the presence of certain forms of animal life, or of their abundance. For example, Dr. Kolenat, *ut cit.*, asserts, that in water containing an excess of lime or oxide of iron, only certain subfamilies of the *Phryganide*, as the *Sericostomides* and the *Rhyachophilides* which inhabit sessile cases attached to stones, are to be found, to the exclusion of those subfamilies which occupy cases swimming freely in the water. In such waters, the writer claims that the propagation of fish cannot be advantageously conducted.

It should be borne in mind, that throughout nature, conditions are ever changing. It would be difficult to cite a locality where the conditions of to-day are those of a century ago; often a decade of years suffices to produce material modification, especially when human agency lends its powerful aid—always in the direction of disturbing the harmony in nature which had previously existed. Forests are felled: the fauna which they harbored—the mammals, birds, reptiles, insects—perish with it, or are driven elsewhere. The streams which they sheltered are dried up, or change their character with the season, and the larger bodies to which they are tributary, are modified in temperature, in their soluble constituents, in area, in the flora and geological nature of their bed. Mills are erected, dams are constructed, and factories discharge their poisonous chemicals into the once pure waters. A too ardent pursuit of the pleasures of angling, or an excessive love of gain, may have thoroughly depleted waters which before had teemed with the animal life natural to it.

With the evidences of such changes wrought, through the operation of known causes, it would be inexcusable to accept a present unfavorable condition as unalterable. We find a stream barren of animal life; it has neither fish nor, apparently, food for fishes. Tradition does not tell us whether it has always lain thus, or whether it once swarmed with occupants. It may have rested so long fallow, that it only needs the dropping of the seed to insure a bountiful return; or, in addition to the seed, its food-elements may also have to be added.

In view of the valuable results which have attended the labors of your Commission thus far, it would seem to be proper that the attempt should be made to cultivate every now barren piece of water within our State, particularly as it may be undertaken with the prospects of success.\* I purposely employ the word *cultivate*, for its use, I believe, is authorized by the examinations which I have made in accordance with the request of your board, and heretofore referred to.

\* It is asserted that, in China, every body of water of the extent even of a small pond, has been utilized for fish-culture, and that an acre of water yields a larger return than an equal area of land.

It is not to be expected that many of our waters will require *cultivation*, in order that they shall yield an ample return for the comparatively trifling labor and expense attendant upon the present system of pisciculture. It is not improbable that careful observation, or a series of experiments, may admit of so judicious a planting in each locality of the species of fish fitted for, and adapted to, the particular locality, that nothing farther shall be necessary. The food required may be there already, although not detected by us. The shallow rivulet may contain its myriads of crustacean and insect forms, so small as to have escaped the eye. The bottom of the lake may be alive with crustacea, whose presence is first disclosed to us by the dredge, or in the examination of the stomach of a bottom-feeding fish.\*

But it may be desirable that localities already producing largely should double their product; then, of necessity, cultivation must be resorted to. As very few of our fields or gardens are so bountifully supplied by nature with all the elements requisite for an abundant annual harvest, that they do not need a return to be made of some of the substances entering into the production of the crops which are taken from them, so we may not expect that our waters are to be brought up to the standard of their greatest productiveness, without some provision for the larger draft made upon them. The food-supply must be increased by successive plantings, as provision for the greater size or increased numbers of the consumers.

Again, as there are soils which are wanting in nearly every element, except moisture, of proper plant-growth, so there are waters, which, from some cause, may be destitute of fish-food. If desirable to render these productive, the food must be supplied. Were it necessary that this should be done annually, as with a barren field, the attempt at reclamation would seem a hopeless one; but the entomologist, with a knowledge of the prolific nature of many species, their rapid development, the successive broods throughout the year, offers the encouragement of the probability that a single planting of insect life, under favoring conditions, would perpetuate itself.

The considerations above advanced, together with others which have presented themselves to me, lead me to regard the suggestion made by your board, of super-adding to the planting of fishes that of the planting of fish-food, as one, which, if it be successfully carried into effect, will mark a new era in pisciculture. By its means, every body of water, suited by nature for the purpose, could be made productive, and the productiveness of those already remunerative largely augmented.

#### THE PRACTICABILITY OF TRANSPLANTING FISH-FOOD.

The transplanting of food as proposed would be attended with little difficulty. The insects, crustaceans and other animal forms could be collected from ponds or streams in which they abound, and, with mosses and aquatic plants placed in large cans filled with water, such as are employed for the transportation of young fish. In this manner, they could be sent to any locality within the State, which could be reached within a reasonable time, accompanied with such instructions for placing them in the water, as are now sent with the shipments of young fish.

A still more convenient method would be to substitute for the cans, as requiring less care in handling, boxes, kegs or barrels, to be lightly filled with the plants containing the several forms as collected. Or, when it is desirable to send larger numbers of the insect and crustaceans, the packages could be filled with successive layers of aquatic plants or mosses, and animal forms—so lightly packed

\* See page 90, for the discovery of *Mysis relicta* in Lake Michigan.

as to avoid crushing, and not to interfere with a certain degree of freedom of motion. During the writing of these pages, a box has been received at the State Museum, from Caledonia creek, containing in *Chara vulgaris*, a common water-plant in that locality, the following forms of animal life: fishes, lizards, crawfish, shrimps, beetles, water-bugs, water-boatmen (*Gerris* and *Coraxis*), gnats, shells, leeches, and the larvæ of beetles, caddis-flies, dragon-flies and May-flies. Although the capacity of the box did not exceed a cubic foot, it contained hundreds of living shrimps, caddis-worms and larvæ of gnats, and numerous examples of other forms. So much of the *Chara* had been placed in the box, that it had unfortunately crushed out the life from most of the usually hardy "miller's thumbs" (*Cottus*) and the delicate "stickle-backs" (*Gasterosteus*); still a number were found, which, being transferred to water, swam as lively as if they had not been banished from their natural element for twenty hours.

To illustrate the facility with which the above collection could be made at Caledonia creek, it may be mentioned that in the month of December last I took from the water's edge a single bunch of moss resting on a stone in the water, which gave me a representation of the six following groups:—fishes, reptiles, crustaceans, insects, worms and mollusks.

In the transplanting of fish-food, if the greatest benefit is to be derived from it, it would be proper that it be regulated by a knowledge of the particular localities best adapted for the permanency and increase of the transferred species. While we are often surprised at the ability of accommodation to changed circumstances displayed in the animal kingdom,\* still the probability of success is greater when we work in accordance with established laws, than when we wander in the field of experiment.

Thus, among the Neuroptera, the larvæ of the *Ephemeridæ* and the *Perlidæ*, require for their abundant propagation, certain conditions of the bottom and banks of the streams which they occupy; for the former, a sloping, muddy bank, in which the larvæ reside (see page 77), and for the latter, a bed of stones, beneath which the larvæ conceal themselves. Dr. Hagen suggests that the needed conditions may be artificially provided; as, for example, for the *Ephemera* the bank may be prepared of loam, sloping at an angle of about forty-five degrees.

The transplanting of insects need not be confined to the aquatic forms. There are numerous other species, which, in their larval state, if favorably placed for the purpose, would contribute largely to the food of fishes. The larvæ of the saw-flies, belonging to the *Hymenoptera*, often live together in large companies. Many of these, and other classes of insects, have the habit of eluding their enemies by dropping from the leaves to the ground, where they hide until the danger is past. When they have attained maturity they frequently drop to the ground, perhaps by the aid of a thread spun for the purpose, as the most convenient means of reaching the place of their transformation. The willows are a favorite food-plant for several species of saw-flies and other gregarious larvæ. When these overhang the streams they furnish a large supply of insect food to the fishes, who are quick to discover the favorable feeding ground. The planting of willows, therefore, together with such other shrubs and trees as are known to be favorite food-plants of insects, in position

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\* I once entirely stripped a caddis-worm of its case of bits of leaves and stems of aquatic plants, and placed it in a vessel containing only some small shells of *Helix*, *Pupa*, etc. The following morning it was found to have made for itself a new case composed of these shells, which, to all appearance, was as well-suited to its purpose as its original, consisting of such very different material.

to project over the water, would be a simple method of contributing largely to the fish-food of our ponds and streams.

The disussion of the above topics—the practicability and the desirability of transplanting fish-food, has also suggested another to my mind, equally and perhaps more important, which I beg leave to present for the consideration of your board, viz. :

#### THE PROPAGATION OF FISH-FOOD.

The proposition to propagate crustaceans and insects for fish-culture must be regarded as intimately connected with that of transplantation—perhaps as a corollary of it. If transplantation be attempted to any great extent, then it follows that the supply of food must be somewhat commensurate with its need. Few localities in our State (perhaps none other than Caledonia) are so bountifully provided by nature, that they could contribute, to any great extent, of their surplus of animal life for the improvement of less favored waters. A single planting from Caledonia creek to a Long Island trout stream would, in all probability, add to the latter some forms not previously existing there, which might be expected to perpetuate themselves; while in a stream not abounding in fish, and therefore presumably characterized by a scarcity of animal food, a single planting would naturally be appropriated by the hungry occupants before the several species could be established. A stream destitute of fish, and equally devoid of other life, would need the nursing of a term of years, or of several bountiful plantings, in order to render it profitable for pisciculture.

All these, and other like difficulties, would find their remedy, in a propagation of fish-food, on such a scale, as seems to the writer within the easy limits of practicability. The artificial propagation of fish, in its application to the increase of the food-supply of our lakes and rivers, is of recent date, and already your board are prepared to meet all demands made upon them for stocking the waters of our State with fish appropriate to them—even our rivulets, with the speckled trout. In view of what has already been accomplished, it is not unreasonable to predict, that, in the event of these recommendations meeting the approbation of your board, within a few years, cans of crustaceans and insects will be the usual accompaniment of the cans of fishes dispatched from the State Hatching-house, in response to such requests as, “send me five thousand brook-trout and a hundred thousand shrimps.” Should you raise the question—“In our artificial fertilization of ova, are not our results the consequence of aiding and improving upon nature?”—my reply would be, true; but the ordinary laws of nature give us a prodigality of insect life, almost infinitely in excess of fish fecundity, even as displayed in the enormous herring-shoals of the North Atlantic. A fish deposits her spawn but once during the year; but in the aphid, or plant-louse, in one year there may be twenty generations. Latreille says that a female aphid produces usually about twenty-five young each day; and Reaumur proved by experiment, that a single aphid might be the progenitor of 5,904,900,000 (nearly six billions) descendants during its life. The crustacea are, also, remarkably prolific: a naturalist has found above twenty-one thousand eggs in a lobster, and Leeuwenhœek seems to compute four millions in a crab.

In view of such facts, an attempt to stimulate the fecundity of nature in the production of her insect hosts, must seem a superfluous undertaking. Protection is all that would be needed.

The propagation of food for fishes is already in practice, in the simple form of placing over a fish pond the flesh of some animal, so arranged that its decom-



position shall attract flies for the deposition of their eggs, the grubs proceeding from which will drop into the water to feed the fish.

A method somewhat allied to this, would be that of obtaining the eggs of certain species of insects, having the habit before referred to, of dropping to the ground when alarmed or in readiness for pupation, and placing them upon their appropriate food-plants projecting over the water—the larvæ to serve as fish-food during their growth. It is believed that there would be no insuperable difficulty in procuring the eggs of some of the species in sufficient quantity for this purpose, in consideration of the fact, that under the stimulus of the profit resulting from sericulture, the eggs of the silk-worms are produced in such quantities, that a *freight-car laden entirely with them*, recently passed through Albany, en route from California to Europe.

From the habit inherent to many of the insects and to most of the aquatic forms of the animal kingdom, of preying upon one another, it would be necessary to propagate most of the species separately. The predaceous water-tigers could not be reared with the defenceless, herbivorous Phryganids; the larger forms of the dragon-flies with the smaller coleopterous larvæ; the Dysticus larvæ with the shrimps.

It would also be necessary, in order to insure complete protection to such species as are particularly liable to be preyed upon by other insects, that they should be reared under cover. If, for example, the *Phryganidæ* are to be propagated, the aquatic plants upon which the larvæ feed, would require not only considerable space, but an exposure to light. If an open pond were devoted to them, freed, if possible, at the outset, from every enemy, their presence, or even the water-surface and its vegetation, would soon attract hither the dragon-flies (*Odonata*) and water-beetles (*Dytiscidæ*, etc.), for the deposition of their eggs upon the plants, and the consequent speedy population of the water with hosts of insect foes.

The cover, either of suitable netting or glass, in addition to the protection it would afford, would also prevent the escape of the insects when they have attained their winged form; and, furthermore, insure the return of their progeny to the water devoted to their propagation.

For many forms, properly constructed and arranged aquaria, of a capacity to admit of the introduction of the requisite vegetation, would be all that would be needed. They would afford ready means for isolation, and for the confinement of the perfect insects for securing the eggs.

If the suggestion last advanced—that of the propagation of fish-food, be regarded as valuable by your board, and as giving promise of aiding materially in the important work of your Commission, I would, in addition, propose, with your approval and coöperation, personally to test the value of some of the suggestions offered. The aquarium of the State Museum (of a capacity of sixty-five gallons), could be used for the purpose. The State Botanist, Prof. Peck, would cordially lend his aid in stocking it with such forms of vegetation as would seem desirable (with the rare *Hypnum noterophilum* of Caledonia creek, and other Caledonia mosses), and in other matters connected with his department.

In view of the superiority of crustacean food, it would be a great achievement, if the propagation of some of the more desirable species could be successfully prosecuted. All the efforts thus far made to rear the lobster in confinement have proved failures. It undergoes during its growth several transformations, in one of which its abode in deep waters seems essential to its development, and has also served to conceal from us that portion of its life-history.



The craw-fish, *Astacus fluviatilis*, under liberal appropriations made by the government, is, at the present time, extensively cultivated in the rivers and brooks of France for table use.

The small crustaceans of the family of *Gammaridae*, noticed in preceding pages, undergo no metamorphoses after their escape from the egg, and, therefore, give promise of less difficulty in their propagation. They have not, however, been reared from the egg, and we are still without their complete history. Even their food is somewhat in doubt; but they are believed to be principally vegetable feeders, although eating animal matter in a decaying state, when convenient to them.

Although, under these circumstances, it would be but an experiment, I propose to undertake the propagation of *Gammarus fasciatus*—the species so abundant at Caledonia, and which, therefore, should not prove very difficult to rear. Prof. S. I. Smith, of Yale College, New Haven, whose successful study of the Crustacea has necessitated his frequent citation in these pages, informs me that this species probably breeds throughout the spring and summer, as females taken at various times, from March to August, are found carrying eggs or young in various stages of development. From the fact that females with undeveloped eggs and others with fully developed young, occur together during so long a period, while very few are observed without eggs or young; and further, that the development of allied species is very rapid, Prof. Smith infers that the same female breeds several times during the season.

The above is about all that is known of the habits of this species; but it leads us to hope that there will be found no insuperable difficulties in its propagation in confinement, or in its rapid multiplication.

My acknowledgments are due to Mr. Seth Green, and to his brother, Mr. Monroe A. Green, for the facilities afforded me for my examinations, and for courtesies extended to me during my visit to Caledonia.

I desire, also, to bear my testimony to the admirable manner in which the operations at the State Hatching-house are conducted. It is difficult to see in what direction further improvements can be made. The extreme care displayed in all the minute details connected with the operations, on the part of each one of the trained assistants engaged, certainly deserves the remarkable success which has signalized the labors of your Commission.

N. Y. STATE MUSEUM OF N. H., }  
March 12, 1878. }



## ANNELIDA CHÆTOPODA OF NEW JERSEY.

By H. E. WEBSTER.

The Annelida catalogued and described in the following pages, were collected in June and the first half of July, 1878, by the writer and a number of students from Union College, forming the usual summer zoölogical party, or "Natural History School," sent out by the college. The locality was Great Egg Harbor, N. J., our residence and point of departure being Beesley's Point. The harbor is quite shallow, with a narrow channel carrying from ten to fifteen feet of water. Outside of the channel at low water, there is from one to three feet of water, and the bottom is covered for the most part with a dense growth of grass and seaweed. As usual, by far the greater number of species were obtained with the spade, between tides. In collecting and taking care of the annelids, I was very much aided by Mr. James E. Benedict. Mr. Benedict had general charge of the shore work, giving especial attention to the birds, but managed to find time for much good work on the annelids. Mr. C. M. Culver, relieved me of much care and responsibility by taking general supervision of the marine invertebrate collecting and collections; while Mr. H. H. Dey Ermand, although acting as Mr. Benedict's assistant in shore work, did good service in marine collecting, from time to time. We were very fortunate in our boatman, Mr. Aaron Clark, of Beesley's Point, and I can heartily recommend him to hunting, fishing and collecting parties. During this winter (1878-79), we have received from him a fine lot of birds in good condition for mounting. I mention this fact, because, in common with others, I have found it very difficult to find men competent to collect and care for birds or other natural history objects, except under direct supervision.

The results of the work on the chaetopod annelids may be summarized as follows :

Number of Families represented..	23
Genera .....	50
Species. ....	57

It was found necessary to establish two new genera STREBLOSPIO and PARAXIOTHEA; of the species fourteen are believed to be new; one genus, GRUBEA, has not previously been reported from our coast, although the species is probably not new. The specimens upon which the work is based are in the Museum of Union College, and a nearly complete series has also been deposited in the New York State Museum of Natural History.

### Fam. POLYNOIDÆ.

#### LEPIDONOTUS (*Leach*) *Kinberg*.

Fregatten Eugénies Resa; Zoolögi, ii, Annulata, p. 13.

#### LEPIDONOTUS SQUAMATUS *Knbg.*

*Aphrodita squamata* LINN. Syst. Nat., ed. x, p. 655. 1758.

*Polynoë squamata* SAVIGNY. Syst. des Ann., p. 22. 1820.

- Polynoë squamata* AUD. & M. ED. Littoral de la France, vol. ii, p. 80, pl. i, figs. 10-16. 1834.
- " " GRUBE. Familien der Anneliden, p. 36. 1851.
- " " QUATR. Hist. Nat. des Ann., vol. i, p. 218. 1865.
- " *dasypus* QUATR. Hist. Nat. des Ann., vol. i, p. 226. 1865.
- Aphrodita punctata* ABLDG. Zool. Danica, vol. iii, p. 25 (non figs. pl. 96). 1789.
- " " O. FABRICIUS. Fauna Greenlandica, p. 311. 1780.
- Lepidonote punctata* CERSTED. Ann. Dan. Consp., p. 12, figs. 2, 5, 39, 41, 47, 48. 1843. Grön. Ann. Dors., p. 16. 1843.
- " *armadillo* LEIDY. Marine Invert. Fauna, N. J. & R. I., Ex. Jour. Phila. Acad., series ii, vol. iii, p. 16, pl. xi, fig. 54. 1855.
- Lepidonotus squamatus* KNEB. Fregatten Eugénies Resa omkring Jorden. Vetenskapliga Jakttagelser. Zoologi, Annulata, p. 13, pl. iv, fig. 15. 1857.
- " " JOHNSTON. A Catalogue of the British Non-parasitical Worms, p. 109, pl. viii, fig. 1. 1865.
- " " MALMGREN. Nordiska Hafs-Annulater; Öfvers. af K. Vet. Akad. Förh., p. 56. 1865. Annulata Polychæta, p. 130. 1867.
- " " BAIRD. Linn. Proc. Zoölogy, vol. viii, p. 182. 1865.
- " " MÖBIUS. Untersuchung der Ostsee, p. 112. 1873.
- " " VERRILL. Invert. Animals of Vineyard Sound, etc., in Report of U. S. Commissioner of Fish and Fisheries, Part I, p. 581. 1874.
- " " WEBSTER. Annelida Chaetopoda of the Virginian Coast, in Trans. Albany Institute, vol. ix, p. 204, pl. i, figs. 1-5. (Advance copies, Jan. 1879.)

*LAGISCA Malmgren.*

Nordiska Hafs-Annulater, p. 65. 1865.  
Annulata Polychæta, p. 133. 1867.

*LAGISCA IMPATIENS n. sp.*

PLATE I, FIGS. 1-7.

Head (fig. 1) broader than long, sides convex, posterior margin concave, slightly depressed along the median line.

Eyes large, lateral, remote from each other, black.

Antennæ covered with minute, cylindrical papillæ, which are a little swollen and lobed at the end; median, cylindrical for inner two-thirds, outer third conical, delicate; basal article large, swollen; in length falling a little short of the palpi; lateral, about one-half as long as the median, fusiform; basal articles cylindrical, a little longer than that of the median antenna.

Palpi smooth, very changeable in form, at rest a little longer than the median antenna, tapering uniformly to near the end, where the diameter suddenly diminishes.

Tentacular cirri with cylindrical basal articles; superior about the length of median antenna; inferior but little shorter than superior; these cirri, together with the dorsal and anal cirri, have the same structure, in all respects, as the median antenna, but the dorsal cirri are a trifle longer than the superior tentacular cirri, and the anal are a little longer than the dorsal.

Elytra, first pair (fig. 5) nearly circular; the rest (fig. 6) reniform; covering the body completely in front, but further back not quite touching along the middle line, leaving a narrow, naked, median space; when magnified, seen to be covered with minute granules, around each of which is a circular depression;

outer margin fringed; from two to seven rather stout, cylindrical papillæ arising from the surface, near the posterior margin; last seven segments without elytra.

Feet (fig. 2) of the usual form, margins of both dorsal and ventral rami with flattened somewhat triangular prolongations; ventral cirri arising at about the outer third and projecting a little beyond the foot, sparsely covered with papillæ similar to those found on the superior cirri.

Setæ of dorsal ramus quite stout (fig. 4), numerous, about half as long as the ventral setæ, although the longest dorsal are as long as the shortest ventral; those of the ventral ramus (fig. 3) long, numerous, ending in a single curved point. The dorsal setæ are usually more numerous than in fig. 2, very nearly concealing the prolongation of the ramus.

Color. Head, flesh-color; palpi, brown with white tips; antennæ and all superior cirri with one or two black rings at about the outer third; elytra extremely variable; they may be white, yellow or flesh-color, with markings varying much both in form and extent, and in color from light brown to very dark brown; on one specimen the elytra were light orange, with transverse linear markings of dark brown, on the anterior segments; body usually white above, without markings, or with transverse lines or spots of black or purple; the last segments have usually black markings; the ventral surface may be white, or white tinged with red or purple.

This species is very fragile, readily breaking up and losing their elytra when disturbed. Middle third widest; last third tapering rapidly; first third slightly tapering.

Length of adult specimens, 25<sup>mm</sup>; width, 4-6<sup>mm</sup>.

Common, associated with *Lepidonotus squamatus*, and like that species abundant on beds of *Mytilus edulis*.

## LEPIDAMETRIA Webster.

Annel. Chæt. of the Virginian Coast, p. 209. 1879.

### LEPIDAMETRIA COMMENSALIS Webster.

Op. cit., p. 210, plate iii, figs. 23-31.

Not common; only three specimens were collected.

Lives in the tube of *Amphitrite ornata* VERRILL.

## Fam. SIGALIONIDÆ.

### STHENELAIS Kinberg.

Annulata Nova., etc., Öfvers af Kongl. Vet-Akad-Förh. 1855.

### STHENELAIS PICTA Verrill.

VERRILL. Invert. Animals of Vineyard Sound, etc., p. 582. 1874.

WEBSTER. Annel. Chæt. of the Virginian Coast, p. 213. 1879.

Not common. Dredged.

## Fam. NEPHTHYDIDÆ.

[NEPHTHYS *Cuvier*.NEPHTHYS INCISA *Malmgren*.

*Nephtlys incisa* MGRN. Nordiska Hafs-Annulater, p. 105, pl. xii, fig. 21. 1865.

Annulata Polych., p. 141. 1867.

*Nephtlys ingens* VERRILL. Invert. An. Vin. Sound, etc., pl. xii, figs. 59, 60. 1874.

“ “ WEBSTER. Annel. Chæt. of the Virginian Coast, p. 213. 1879.

*Nephtlys incisa* VERRILL. Check List. 1879.

Not common. Found in sand and mud; low water to fifteen feet.

NEPHTHYS PICTA *Ehlers*.

EHLERS. Die Borstenwürmer, p. 632, pl. xxiii, figs. 9, 35. 1868.

VERRILL. Invert. An. Vin. Sound, etc., p. 583, pl. xii, fig. 57. 1874.

WEBSTER. Annel. Chæt. of the Virginian Coast, p. 214. 1879.

## Fam. PHYLLODOCIDÆ.

ANAÏTIS *Malmgren*.

Nordiska Hafs-Annulater, p. 94.

ANAÏTIS SPECIOSA *n. sp.*

PLATE I, FIGS. 8, 9.

The outline of the head conforms perfectly to Malmgren's generic description; the middle third of the posterior margin curves suddenly backward, encroaching upon the anterior margin of the first segment, the sides and front are regularly rounded, forming a semicircle.

Antennæ delicate, conical, length about one-half the width of the head; only the upper pair can be seen from above; both pairs arise from the lower surface of the head, upper also external and pointing outward, lower directed downward.

Eyes large, circular, lateral, posterior: first segment prolonged forward as far as the front of the eyes, embracing the sides of the head.

Tentacular cirri arise from short, stout basal articles, are stout at base, regularly and acutely conical; first and second equal, a little shorter than the third, which reaches back to the front margin of the fourth setigerous segment; the fourth cirrus, or cirrus of the second segment, as long as the third.

Dorsal cirri (branchiæ) broad heart-shaped (fig. 8), with long basal attachment, retaining the same form throughout; feet (fig. 8) cylindrical, bilabiate; ventral cirri with slightly convex lower margin, nearly straight or slightly concave upper margin; apex bluntly rounded, a little shorter than the feet: anal cirri circular, a little thicker than the dorsal.

Setæ (fig. 9) long, slender, with very long and delicate appendix; the stem ends in two sharp curved points, one much longer than the other.

Color: head and first two segments white with brown specks; dorsum generally dark green; between the segments a narrow spindle-shaped band of umber-brown; eighth and ninth segments umber-brown, giving a well-defined band

of the width of these two segments; dorsal cirri green, not quite so dark as the dorsum, with a central brown spot, extending to their attachment on the segments 3-9; after the ninth segment this marking becomes obsolete. Ventral surface light green, growing darker externally, and with reddish-brown lateral markings along the posterior third; feet and ventral cirri dark green at base, growing lighter further out. Anal segment brown. The general color of the body in one instance was reddish-yellow; in another all the markings were very dark-brown, nearly black, in place of the umber-brown. The transverse band on the eighth and ninth segments is still visible, after six months' preservation in very strong alcohol. Body slightly convex above, flattened below; the first segment is much wider than the second, but shorter; the second is narrower than the head; the middle third of the body has a uniform width, about double that at either extremity.

Length of adult specimens, 10-12<sup>mm</sup>; width, 1.5-2<sup>mm</sup>.

Found occasionally at low water; quite common on beds of *Mytilus edulis*.

### PHYLLODOCE (Sav.) Malmgren.

MALMGREN. Nord. Hafs-Ann., p. 94.

#### PHYLLODOCE ARENÆ n. sp.

PLATE II, FIGS. 10-12.

Head bluntly rounded in front, diameter increasing backward to the middle line, just back of the middle slightly constricted; margins behind the constriction straight; posterior margin with a deep triangular emargination; lateral lobes broadly rounded.

Antennæ short, conical, rather stout, their length about equal to the anterior diameter of the head.

Eyes situated at posterior third of the head, latero-dorsal, large, circular, dark brown to black.

Tentacular cirri; first and second equal, reaching some distance beyond the head; second and third equal, about double the length of the first, reaching back to the ninth or tenth segment, subulate. On the first segment, in the triangular space between the posterior lobes of the head, there is a small, blunt papilla, its length about equal to the base of the triangle; this papilla is obvious in fresh specimens, but is seen with difficulty in alcoholic specimens.

Dorsal cirri of the anterior segments (fig. 10), broad heart-shaped, from the twenty-fifth segment somewhat quadrangular (fig. 11), and with the inner margin abruptly turned up, presenting a narrow surface nearly at right angles to the larger outer part of the cirrus; the line of union of the two surfaces is thickened and densely covered with long cilia.

Ventral cirri, lower margin convex, upper margin nearly straight in front; they are rounded externally, pointed behind.

Setæ numerous, of one kind only (fig. 12), very long with a flexible capillary termination; the stem is roughened near the articulation by numerous projecting

points; the appendix is joined to the stem by a delicate membrane, and is minutely denticulated along its thin margin.

Anal cirri short, conical.

Color: on the dorsum each segment has a dark brown crescent on both its anterior and posterior margin, while the intervening part is green; thus there are transverse, hour-glass shaped green markings, alternating with spindle-shaped brown markings; on the first ten or twelve segments the brown falls a little short of the outer margins of the segments. The dorsal cirri are greenish-white with a large patch of brown at base, not quite so dark as the brown of the dorsum. Back of the middle of the body a second brown spot appears on the outer central part of each cirrus. The ventral surface is light green with a central brown spot on each segment, and a similar spot between the bases of the feet. The head, antennæ and tentacular cirri are white.

Proboscis not seen in full extension, basal portion closely covered with longitudinal series of conical papillæ, except a narrow, naked space above.

Body tapers slightly along the posterior third, but is of nearly uniform diameter throughout.

From the twenty-fifth segment the middle (green) part of each segment is ciliated. Three specimens were found, two of which were colored as described above, while the third had white everywhere replacing the green.

Length, 10<sup>mm</sup>; diameter, 1<sup>mm</sup>; diameter including feet, 2.5<sup>mm</sup>.

Found near low-water mark, in sand.

#### *EUMIDA Malmgren.*

Nord. Hafs-Annulater, p. 97. 1865.

#### *EUMIDA MACULOSA Webster.*

Annel. Chat. of the Virginian Coast, p. 215, pl. iv, figs. 38-41. 1879.

Very common on shells, etc., from low-water to fifteen feet.

#### *EULALIA (Sav.) Malmgren.*

MALMGREN. Nord. Hafs-Annulater, p. 98. 1865.

#### *EULALIA? ANNULATA Verrill.*

Invert. Animals of Vineyard Sound, etc., p. 291. 1874.

A single specimen, having the anterior portion only, was found, which probably belongs to Verrill's species.

#### *ETEONE (Sav.) Ærsted.*

ÆRSTED. Annulatorum Dan. Consp., p. 29. 1843.

#### *ETEONE ALBA n. sp.*

PLATE II, FIGS. 13-16.

Head longer than broad, wide at base, apex bluntly rounded (fig. 13); a slight depression just above the bases of the lower antennæ, and another similar depression just back of the upper antennæ.



Antennæ small, conical; the upper, about equal in length to the width of the apex; the lower, a trifle longer. On the middle line of the head, just back of the eyes there is a small papilla, which can be seen only with difficulty in living forms, and can hardly be demonstrated in alcoholic specimens.

Eyes small, circular, widely separated, situated at about the posterior fourth of the head; on young specimens, red; on adults, black.

Buccal segment nearly as long as the three following segments taken together.

Tentacular cirri; upper nearly as long as superior antennæ, but more delicate; lower, three times as long as upper, and stouter, but still very delicate.

Dorsal cirri pretty evenly rounded, quite small on the anterior segments (fig. 14), growing larger behind (fig. 15).

Ventral cirri, in front larger than the dorsal, lower margin strongly convex, upper margin straight, apex acute; further back they are larger than in front but smaller than the dorsal cirri, their margins slightly convex, apex bluntly rounded.

Anal cirri short, subulate.

Setæ (fig. 16) numerous, short, stem reaching but little beyond the feet; appendix also short, rather wide at base, termination capillary, one edge minutely denticulated.

Body elongated, in front flattened, further back rounded above, flat below; tapering rapidly along the anterior third, gradually along the posterior third.

Color white, or white with flake-white specks, sometimes with an intestinal brown line showing through.

Length of largest specimens, 45<sup>mm</sup>; width with feet, 1.5<sup>mm</sup>.

Rare; low water to fifteen feet.

#### ETEONE LIMICOLA *Verrill*.

VERRILL. Invert. Animals of Vineyard Sound, etc., p. 294. 1874.

This species, reported by Verrill from Great Egg Harbor, we failed to find.

### Fam. HESIONIDÆ.

#### PODARKE *Ehlers*.

Die Borstenwürmer, p. 190. 1864.

#### PODARKE OBSCURA *Verrill*.

PLATE II, FIGS. 17, 18.

VERRILL. Invert. An. of Vin. Sound, etc., p. 589, pl., xii, fig. 61. 1874.

WEBSTER. Annel. Chæt. of the Virginian Coast, p. 216. 1879.

Rare; low water to fifteen feet.

#### PODARKE LUTEOLA *n. sp.*

PLATE II, FIGS. 19, 20.

Head very slightly convex in front, posterior margin slightly concave, and a little shorter than the front margin, the sides being directed a little inward; length to width as 1 to 3; angles all bluntly rounded.

Antennæ: median lost; those in pairs delicate, subulate, without basal articles. Upper pair situated just above the lower, their length about equal to the width of the head; lower pair a little shorter than upper.

Eyes dark red; anterior pair large, circular, latero-posterior; posterior pair a little within the front pair, almost in contact with them; crescentic, concavity directed outward and backward.

Tentacular cirri six pairs, arising from short, cylindrical basal articles, borne on the first three segments, two pairs to each segment; upper cirri as long as the dorsal cirri, or even a little longer; lower about one-half as long as the upper. The first four pairs on each side seem to arise from the sides of the head; this is due to the fact that the first and second segments are not visible from above, except as narrow lateral bands extending forward on the head as far as the anterior eyes; these segments are well defined below; in alcoholic specimens they cannot be seen from above, and even in living forms the line of division between the sides of the head and the lateral prolongations of these segments is not easy to demonstrate.

Dorsal cirri very long, delicate, tapering uniformly, basal articles short, cylindrical (fig. 19).

Feet biramous; upper ramus a stout papilla arising just below the base of the dorsal cirrus; lower ramus stout, elongated, terminating above in a conical process, below which the end of the ramus is bluntly rounded, almost truncate.

Ventral cirri arise from lower outer margin of the ventral ramus, delicate, conical, about one-sixth as long as the dorsal cirri.

Setæ: dorsal very long, slender, capillary, forming a close-set bundle, arising from the summit of the dorsal ramus; ventral (fig. 20) of the form usual in this genus, hardly to be distinguished from the ventral setæ of *Podarke obscura* VERRILL, except that they are longer, and that the stem has transverse markings, which I have never been able to see in the setæ of that species. The difference in length between the setæ of the two species is due almost entirely to the elongation of the stem in the setæ of *P. luteola*.

Body slightly convex above and below, widest in front, tapering very gradually. The feet increase in length from the first pair to the middle a little faster than the body narrows, so that the widest part, including the feet, is in the middle.

Anal cirri in all respects similar to the dorsal.

Color: reddish-yellow dorsally; feet green or yellow above, green laterally; ventral surface a shade lighter than the dorsal; antennæ and all cirri white.

Length, 11<sup>mm</sup>; width, including feet, 2<sup>mm</sup>; number of segments, 45.

A single specimen was found on an oyster shell at low water.

This species is easily distinguished from *Podarke obscura* VERRILL (the only species of this genus previously described from our coast), by the form of the head—lack of basal articles for the antennæ, apparent origin of the tentacular cirri of the first two segments, great length, and short basal articles of the dorsal cirri, etc

Fam. SYLLIDÆ.

SYLLIS (Sav.) Ehlers.

EHLERS. Die Borstenwürmer, p. 222. 1864.

SYLLIS GRACILIS Grube.

- Syllis gracilis* GRUBE. Actinien, Echinodermen und Würmer, p. 77. 1840.  
 “ “ CAPAREDE. Glanures Zoötomiques parmi les Annélides de Port-Vendres, p. 75, pl. v, fig. 3. 1864. Annélides Chétopodes du Golfe de Naples, p. 503, pl. xv, fig. 3. 1868.  
 “ “ MARION AND BOBRETZKY. Annélides du Golfe de Marseille; in Annales des Sciences Naturelles, 6th series, vol. ii, p. 23, pl. ii, fig. 6. 1875.  
 “ “ PANCERI. Catalogo degli Annelide, etc. Atti. Soc. Ital., vol. xviii, p. 520. 1875.  
 “ “ WEBSTER. Annel. Chæt. of the Virginian Coast, p. 217. 1879.

Only a few examples of this species were taken, it being far less common than in Virginia.

ODONTOSYLLIS Claparède.

Glanures Zoötomiques, etc., p. 94. 1864.  
 Beobachtungen über Anatomie, etc. 1863.

ODONTOSYLLIS? FULGURANS Clpd.

- Odontosyllis fulgurans* CLAPAREDE. Glanures Zoötom., etc., p. 95, pl. viii, fig. 1. 1864.  
 “ “ QUATREFAGES. Hist. Nat. des Annel., vol. ii, p. 648. 1865.  
 “ “ MARION AND BOBRETZKY, in Ann. des Sci. Nat., 6th series, vol. ii, p. 40, pl. iv, fig. 2. 1875.  
 “ “ WEBSTER. Annel. Chæt. of the Virginian Coast, p. 220. 1879.

This species was not common. One very large adult male was taken swimming on the surface. Its length was 22<sup>mm</sup>; sexual setæ began on the 21st segment; existed on forty-two segments, followed by thirty-three with the ordinary setæ only. Other specimens were taken on sandy and shelly bottom, 10–15 ft. For further notes on this form, see Webster, l. c., p. 220.

GRUBEA (Quatr.) Claparède.

QUATREFAGES. Histoire Naturelle der Annelés, etc., vol. ii, p. 35. 1865.  
 CLAPAREDE. Annél. Chét. du Golfe de Naples, p. 516. 1868.

GRUBEA TENUICIRRATA Clpd.

- Sphærosyllis tenuicirrata* CLPD. Glanures Zoötom., etc., p. 87, pl. vi, fig. 2. 1864.  
*Grubea tenuicirrata* CLPD. Annél. Chét. du Golfe de Naples, p. 517. 1868.  
 “ “ MARENZELLER. Zur Kenntniss der Adriatischen Anneliden. Ausdem, lxi. Bande der Sitzb. der K. Akad. der Wissench, p. 29. 1874.

In some respects my specimens agree better with *Grubea dolichopoda* MARENZELLER (l. c., p. 26) than with *G. tenuicirrata* CLPD. This is especially the case in the form of the setæ and of the pharyngeal tooth. According to Claparède's figure, the setæ end in a single point, and with the magnifying power used by him this does seem to be the case; in reality they are bidentate, the teeth being very small, and requiring a high power to bring them out distinctly. On only two specimens was the first dorsal cirrus much longer than the second.

The anal cirri, in the only case where they were seen, were as long as the dorsal cirri, and somewhat swollen at base.

Body colorless ; stomach white ; intestine colorless ; eyes very dark reddish-brown.

The sexual setæ begin on the ninth setigerous segment. All the males had lost the posterior part of the body, but on one specimen the capillary (sexual) setæ existed on nineteen segments. The eggs and young in different stages of development agree very closely with those described by Claparède as belonging to *Syllis pulligera* KROHN (*Syllides pulligera* CLPD.), *Glanures*, etc., p. 81, pl. vi, fig. 6.

Not common ; ten to fifteen feet, on shelly bottom.\*

### PÆDOPHYLAX *Claparède*.

Annél. Chét. du Golfe de Naples, p. 520. 1868.

### PÆDOPHYLAX DISPAR *Webster*.

Annel. Chæt. of the Virginian Coast, p. 230, pl. iv, fig. 49 ; pl. v, figs. 50-55. ~~1879~~ 1879.

#### *Male*.

Capillary setæ begin on the eleventh setigerous segment, and are found on all following segments except the last 2-4. They are delicate, longer than the width of the body, including the feet.

The body from the eleventh, or sometimes from the sixth, segment, is pure white and much swollen.

#### *Female*.

Capillary setæ as in the males, only a little shorter.

Eggs attached to the ventral surface by a peduncle, two to each segment ; at first spherical, then becoming elongated ; purple with many black specks.

The constriction dividing the head from the body appears first ; at this time the eyes are apparent, the antennæ are mere buds, equal in length, the palpi are not united along their outer two-thirds.

The young, when detached from the body of the mother, have a well-formed head with appendages, buccal segment with tentacular cirri, five setigerous segments with feet and cirri, and anal segment with anal cirri which are relatively longer than in the adult ; otherwise they do not differ from the adult except, of course, in size and number of segments.

Common on shelly bottom, 10-15 feet.

### AUTOLYTUS (*Grube*) *Marenzeller*.

MARENZELLER. Zur Kenntniss der Adriatischen Anneliden, etc., Zweiter Beitrag, p. 37. 1875.

### AUTOLYTUS HESPERIDUM *Claparède*.

CLAPARÈDE. Annél. Chét. du Golfe de Naples, p. 520, pl. xiv, fig. 1. 1868.

WEBSTER. Annel. Chæt. of the Virginian Coast, p. 225. 1879.

#### *Male*.

No adult males were found, but in one specimen, though not detached, the following modifications of structure had occurred :

Head slightly convex in front ; eyes very large, but not quite in contact ; lateral antennæ arising from the front margin of the head, just before the

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\* Since writing the above I have had further opportunity of studying this species. I am now satisfied that our specimens belong to *Grubea dolichopoda* MARENZELLER. Langerhaus, however, identifies this with *Grubea clavata* CLPD. (*Zeitschrift für Wissenschaftliche Zoologie*, p. 564. 1879.)

anterior eyes, bifurcate at their outer third, swollen at base, three times as long as the head; median antenna arising back of the eyes, near the posterior margin of the head, one-third longer than the head; buccal segment hardly distinct from head, bearing two pairs of tentacular cirri, of which the upper had about the length of the lateral antennæ, the lower, of the median; second segment with ordinary dorsal cirrus; no sexual setæ.

This species was very common from just below water mark to fifteen feet, living on certain forms of sea-weed. In number of individuals it probably surpassed any other species of Annelid found in the harbor.\*

## Fam. NEREIDÆ.

### NEREIS (L.) Cuvier.

#### NEREIS LIMBATA Ehlers.

PLATE III, FIGS. 21, 22.

EHLERS. Die Borstenwürmer. p. 567. 1868.

VERRILL. Invert. Animals of Vineyard Sound, etc., pp. 318, 590, pl. xi, fig. 51. 1874.

WEBSTER. Annel. Chæt. of the Virginian Coast, p. 235, pl. vi, figs. 70-75. 1879.

#### Male.

The dorsal cirri of the first seven segments have a peculiar form, which seems to have escaped notice. Near the end they are slightly enlarged (fig. 21), then suddenly become smaller, ending in a delicate, almost filiform appendix. The dorsal cirri of the middle region have one margin crenulated for nearly their entire length (fig. 22); the ventral cirri have a few crenulations near their outer end.

Found living very near high-water mark, and common everywhere in the harbor, except in pure sand.

#### NEREIS CULVERI n. sp.

PLATE III, FIGS. 23-30. PLATE IV, FIGS. 31, 32.

Head (fig. 23) emarginate in front; anterior half of lateral margins concave, posterior half slightly convex; posterior margin straight; from the anterior emargination, a deep, triangular depression runs backward to the middle line, so that the front half of the head seems to be divided into two lobes, broadly rounded in front; length to width as two to three.

Eyes: anterior pair elliptical or elongate-oval, on the middle line, lateral; posterior pair circular, a little within the front pair, close to the posterior margin.

Antennæ remote from each other at base, conical, length to length of head as three to four.

Palpi very stout with long terminal articles, in extension reaching beyond the antennæ, in contraction falling much short of them.

Proboscis (fig. 24): it is in the structure of this organ that the chief peculiarities of this species are to be found. There are no paragnathi. At the

\* Regarded by Prof. Langerhaus as identical with *Autolytus prolifer* GRUBE. (See *Zeitschrift für Wissenschaftliche Zoologie*, p. 574. 1879.)

summit of the maxillary ring are bunches of short, conical, pointed papillæ, arising from low, marginal elevations, with the arrangement as follows: on the middle line above, a small bunch of four or five papillæ; on the latero-dorsal margin a bunch of ten or twelve arranged in a double series; on the latero-ventral margin a bunch composed of the same number of papillæ, but not arranged in series; a median ventral bunch, six papillæ in double series; half way between the last and the latero-ventral, a small bunch, three to five papillæ. The lateral papillæ, above and below, are about one-third as long as the antennæ, the others a little shorter. Aside from these papillæ, the surface of the maxillary ring is quite smooth. On the ventral surface of the basal ring, near the posterior margin, are five small elliptical elevations or calluses, a median and two lateral, equally distant from each other. The notes made on the living forms make mention of a small, median, triangular papillæ, just in front of the antennæ. It cannot be demonstrated in alcoholic specimens.

Jaws (fig. 25): in color varying from light to dark horn-color; about fourteen strong, sharp teeth.

Buccal segment double the length of the second segment, equal to the fourth.

Tentacular cirri (fig. 23) arise from stout and long basal articles; upper posterior cirrus longest, reaching back to the middle of the third segment, or sometimes to its posterior margin; the lower posterior cirrus and the upper anterior equal, from one-fourth to one-third shorter than the longest; lower anterior cirrus shortest; viewed from below, this cirrus is seen to arise much below the others.

The first two setigerous segments have no dorsal rami (fig. 26), but the cirri, lingulæ, and ventral ramus have nearly the same form as on the segments following. From the fourth to the twentieth-twenty-fifth segment (fig. 27), the dorsal ramus is small, conical, distinct from its lingula; the lingula is longer than the dorsal ramus, broad at base, tapering gradually, apex bluntly rounded, somewhat compressed; the dorsal ramus has two lips, anterior and posterior; anterior small, of uniform diameter, directed upward; posterior larger than anterior, shaped much like upper lingula, but smaller, directed outward; the lower ramus has also two lips, placed one behind the other, stout, bluntly conical, anterior turned outward, posterior a little downward; the inferior lingula is a little stouter at base than the lips of the ventral ramus, otherwise about the same form and size; the ventral cirrus is longer than the dorsal, fusiform, reaches to the middle of its lingula, arising some distance below it.

Further back the basal part of the feet gains in length (fig. 28); the dorsal cirrus becomes shorter; the upper lingula longer, conical, with less diameter; the anterior lip of each ramus becomes gradually smaller, and finally disappears; the lower lingula is greatly reduced in size; the ventral cirrus recedes from its lingula, becoming minute, conical.

On the posterior feet (fig. 29), the dorsal cirrus arises from the base of the upper lingula; the remaining (posterior) lip of the upper ramus becomes delicate, conical, reaching beyond the lingula.

The anal segment (fig. 30) has a slightly crenulated margin; its cirri are delicate, their length more than double that of the longest tentacular cirrus.

Setæ of two kinds; one, with long narrow appendix (fig. 31), one edge minutely denticulated; the other (fig. 32) with short appendix, one margin thickened and rounded, the opposite margin very thin, somewhat coarsely denticulated; those of the second form are found only in the lower bundle of the ventral rami, after the first twenty to thirty segments, from four to six in each bundle, always accompanied by some of the first form.

Color, light flesh-color to reddish-brown; dorsal cirri and superior lingulæ pure gleaming white, other parts of the feet also white; head, especially its posterior half, usually darker than the body.

Body elongate, widest at the eighth segment, diminishing rapidly forward, uniformly but very gradually backward.

This species forms a tough membranous tube, in color dark reddish-brown, fitting the body very closely.

Length of one specimen (140 segments) 60<sup>mm</sup>; width with feet 4<sup>mm</sup>; without feet, 2<sup>mm</sup>; length of a larger specimen, 75<sup>mm</sup>; width with feet, 5<sup>mm</sup>.

Two specimens kept in well-water, not at all brackish, for forty-eight hours, seemed to be in good condition; while specimens of *Nereis limbata* EHLERS treated in the same way stopped all movements in thirty minutes, and in an hour the blood ceased to circulate; the latter were taken at a higher station than that in which the former lived, and where they must often have been exposed to the action of brackish water.

The only place in which this species was found was a few rods above the old wharf, in front of the hotel at Beesley's Point, in coarse sand and gravel, at about half-tide. We looked for them carefully in many other places, where the conditions seemed to be the same, but without success.

#### *Sexual Forms.*

Many males and females, apparently adult, were taken, in which no structural changes had occurred except that the eyes had become a little larger; the anterior pair crescentic; the posterior oval; the body and feet being swollen by the contained sexual products.

The color of the female was unchanged; immature males were bright green; adult males greenish white.

This species was first found by Mr. C. L. Culver, at Beaufort, N. C., in the summer of 1877. Mr. Culver was at that time a student in Union College, and attached to the usual summer zoological expedition of the college. He brought in two specimens with a lot of *Nereis limbata* EHLERS, taken at low water. The exact station was not known, and though we searched diligently and frequently for additional specimens, none were found.

#### NEREIS TRIDENTATA *n. sp.*

PLATE IV, FIGS. 33-40.

Head (fig. 33) deeply emarginate in front, and with a well defined depression carried back to the middle line; behind the middle line the sides are convex;

in front of it, strongly concave; posterior margin slightly convex; anterior margin interrupted by the emargination which divides the apex into two bluntly rounded lobes; length to width as two to three.

Antennæ widely separated at origin, conical, length to length of head as two to three.

Palpi very stout, with long terminal articles. Eyes circular, lateral; anterior pair quite large, situated just back of the middle line; posterior about one-half as large as the anterior, and a little within them, very near the posterior margin.

Buccal segment equal in length to the three following segments taken together; much wider than the head.

Tentacular cirri short, tapering but little, arising from stout cylindrical basal articles; upper posterior cirrus reaches to the middle of the third segment, or to the front margin of the fourth; the lower posterior and upper anterior cirri equal, about two-thirds as long as the longest; lower anterior shortest, one-half as long as the longest.

Proboscis (fig. 33) without denticles (paragnathi) on the dorsal surface; my notes make mention of two minute fleshy papillæ situated one on either side of the middle line of the basal ring, but I cannot find them on the alcoholic specimens; ventral surface of maxillary ring also without denticles (fig. 34), while on the basal ring are three small paragnathi, circular or elliptical, flat, corneous, brown.

The jaws are light horn-color with numerous long sharp teeth.

Feet of the first two setigerous segments without dorsal rami, and with the ventral cirrus much swollen at base (fig. 35), in other respects similar to the feet immediately following them.

Anterior feet (fig. 36), dorsal cirrus finger-shaped, longer than its lingula; lingulae and lips of the two rami tapering but little, nearly cylindrical, very bluntly rounded externally; upper lingula longer than dorsal ramus; dorsal ramus with anterior and posterior lips, anterior shorter than posterior and above it; lower ramus with a long posterior, short anterior lip; lower lingula long, reaching nearly to the outer end of the lower ramus; ventral cirrus delicate, conical, about one-half as long as its lingula.

After the first third the structure of the feet changes gradually (fig. 37); the upper lingula becomes conical, and further removed from the upper ramus; the anterior lips of both rami become much smaller; the lower lingula and the ventral cirrus do not change much; on the extreme posterior feet the dorsal cirrus is longer than elsewhere.

Anal segment simple; anal cirri as long as the last eight segments, filiform.

Setæ of three forms: those of the first form (fig. 38) have the terminal points of the stem in the same plane, appendix very narrow; this is the only kind found in the dorsal rami; they also form the greater part of the upper bundle of the ventral rami, but are not found in the lower bundles; those of the second form have the terminal points of the stem not in the same plane



(fig. 39), appendix short, in other respects like the first form; found in both bundles of the ventral rami, but not numerous; those of the third kind (falcate setæ) are short (fig. 40), with a very short appendix, one margin of which is thickened and rounded, the opposite edge thin, and deficient near the apex; a few of this form are found in the upper bundle of the ventral rami, and they form the greater part of the lower bundle.

Body of uniform width along the anterior half, then tapering very slowly.

Color: body light flesh-color; sides of head and bases of antennæ and tentacular cirri dark reddish-brown; one specimen was light orange.

Length of largest specimen, 29<sup>mm</sup>; greatest width with feet, 3.5<sup>mm</sup>; number of segments, 105. Length of a specimen with 70 segments, 12<sup>mm</sup>.

Very rare: 10 to 15 feet, shelly bottom.

## Fam. EUNICIDÆ.

### DIOPATRA Aud. and M. Edw.

AUDOUINE AND M. EDWARDS. Littoral de la France, vol. ii, Annélides, p. 155. 1834.

#### DIOPATRA CUPREA Claparède.

*Nereis cuprea* BOSCH. Hist. Nat. des Vers., vol. i, p. 143. 1802 (teste Claparède).

*Eunice cuprea* QUATREFAGES. Hist. Nat. des Annelés, vol. i, p. 331. 1865.

*Diopatra cuprea* CLAPARÈDE. Annél. Chét. du Golfe de Naples, p. 432. 1868.

“ “ VERRILL. Invert. Animals of Vin. Sound, etc., p. 593, pl. xiii, figs. 67, 68. 1874.

“ “ WEBSTER. Annel. Chét. of the Virginian Coast, p. 236. 1879.

Quite common on the sand flats at low water, and occasionally dredged at from ten to fifteen feet.

### MARPHYSA Quatrefages.

Histoire Nat. des Annelés, vol. i, p. 331. 1865.

#### MARPHYSA SANGUINEA Quatr.

*Nereis sanguinea* MONTAGU. Linn. Trans., vol. xi, p. 20, pl. iii, fig. 1. 1815.

*Leodice opalina* SAVIGNY. Système des Annélides, p. 51.

*Nereidonta sanguinea* BLAINVILLE. Dict. Sci. Nat., vol. lvii, p. 447. 1828.

*Eunice sanguinea* AUD. AND M. EDW. Littoral de la France, vol. ii, Annélides, p. 147. 1834.

“ “ GRUBE. Familien der Anneliden, pp. 44, 123. 1851.

“ “ “ Die Insel Lussin, p. 79. 1864.

“ “ “ St. Malo and Roscoff, pp. 87, 91, 105, 114, 140. 1870.

“ “ LEIDY. Marine Invert. Fauna, R. I. and N. J., p. 15. 1855.

“ “ JOHNSTON. Catalogue of British Worms, p. 134. 1865.

*Marphysa sanguinea* QUATR. Hist. Nat. des Annel., vol. i, p. 332, pl. x, fig. 1. 1865.

“ “ EHLERS. Die Borstenwürmer, p. 360, pl. xvi, figs. 8-11. 1868.

“ “ BAIRD. Linn. Proc. Zoölogy, vol. x, p. 352.

“ “ MAR. AND BOER. Ann. des Sci. Nat., vol. ii, p. 12. 1875.

“ *Leidii* QUATR. Histoire Nat. des Annel., vol. i, p. 337. 1865.

“ *Leidyi* VERRILL. Invert. An. Vin. Sound, etc., pp. 319, 593, pl. xii, fig. 64. 1874.

“ *sanguinea* WEBSTER. Annel. Chét. of the Virginian Coast, p. 236, pl. vi, figs. 76-80; pl. vii, figs. 81-83. 1879.

This species is by no means common. Some young specimens taken had one antenna, others three antennæ; eyes, four; branchiæ, from tenth segment; palpi hardly apparent.

DRILONEREIS (*Clpd.*) *Webster*.

- CLAPAREDE. Annél. Chét. du Golfe de Naples. Supplément, p. 25. 1870.  
WEBSTER. Annel. Chæt. of the Virginian Coast, p. 240. 1879.

DRILONEREIS LONGA *Webster*.

Annel. Chæt. of the Virginian Coast, p. 240, pl. vii, figs. 84-88. 1879.

Common in sand at low water.

LUMBRICONEREIS (*Blv.*) *Ehlers*.

EHLERS. Die Borstenwürmer, p. 377. 1868.

LUMBRICONEREIS TENUIS *Verrill*.

- VERRILL. Invert. Animals of Vineyard Sound, etc., pp. 342, 594. 1874.  
WEBSTER. Annel. Chæt. of the Virginian Coast, p. 241. 1879.

Not common; sand, low water.

ARABELLA (*Grube*) *Ehlers*.

- GRUBE. Die Familien der Anneliden, p. 45. 1851.  
EHLERS. Die Borstenwürmer, p. 398. 1868.

ARABELLA OPALINA *Verrill*.

- Lumbriconereis splendida* LEIDY. Marine Invert. Fauna R. I. and N. J., p. 10. 1855.  
" *opalina* VERRILL. Invert. Animals of Vineyard Sound, etc., pp. 342, 594, pl. xiii, figs. 69, 70. 1874.  
*Arabella opalina* VERRILL. Proc. Acad. Nat. Sci. Phila. for 1878, p. 299.  
" " WEBSTER. Annel. Chæt. of the Virginian Coast, p. 242. 1879.

Common at low water in sand and mud, and occasionally dredged, ten to fifteen feet.

STAUROCEPHALUS (*Grube*) *Ehlers*.

- GRUBE. Archiv für Naturgesch., p. 97. 1855.  
EHLERS. Die Borstenwürmer, p. 422. 1868.

STAUROCEPHALUS PALLIDUS *Verrill*.

- VERRILL. Invert. Animals of Vineyard Sound, etc., pp. 348, 595. 1874.  
WEBSTER. Annel. Chæt. of the Virginian Coast, p. 242. 1879.

Only one specimen was found—fifteen feet, sand and shells.

## Fam. GLYCERIDÆ.

RHYNCLOBOLUS *Claparède*.

Annélides Chétopodes du Golfe de Naples, p. 492. 1868.

RHYNCLOBOLUS AMERICANUS *Verrill*.

- Glycera Americana* LEIDY. Marine Invert. Fauna R. I. and N. J., p. 15, pl. xi, figs. 49, 50. 1855.  
" " EHLERS. Die Borstenwürmer, p. 668, pl. xxiii, figs. 43-46. 1868.  
" " GRUBE. Jahres-Bericht der Schles. Gesell. für Vaterlän. Cultur, p. 64. 1869.  
*Rhynchobolus Americanus* VERRILL. Invert. An. Vin. Sound, etc., p. 596, pl. x, figs. 15, 46. 1874.  
" " " Proc. Acad. Nat. Sci. Phila. for 1878, p. 300.  
" " WEBSTER. Annel. Chæt. of the Virginian Coast, p. 245. 1879.

Common; low water to fifteen feet.

*RHYNCHOBOLUS DIBRANCHIATUS* Verrill.

*Glycera dibranchiata* EHLERS. Op. cit., p. 670, pl. xxiv, figs. 1, 10-28. 1868.

" " GRUBE. Op. cit., p. 64. 1869.

*Rhynchobolus dibranchiatus* VERRILL. Op. cit., p. 596, pl. x, figs. 43, 44. 1874.

" " WEBSTER. Op. cit., p. 245. 1879.

Common; low water to fifteen feet.

*GONIADA* Aud. and M. Edw.

Annales des Sciences Naturelles, vol. xxix, p. 266. 1833.

*GONIADA SOLITARIA* n. sp.

PLATE IV, FIGS. 41, 42. PLATE V, FIGS. 43, 44.

Head as long as the first seven segments taken together, acutely conical, with minute antennæ.

Eyes small, black, circular, lateral, posterior.

Proboscis not seen in complete extension, covered with numerous longitudinal series of stout hooks; on the dorsal surface three rows of hooks on either side of a naked median space; on the ventral surface four rows, two on either side of the median line; one lateral series; ventral and lateral hooks smaller than the dorsal; at the base, on the ventral surface, numerous, quite small hooks scattered about irregularly.

The first twenty-five segments are uniramous; the ramus has two lips (fig. 41), anterior long and narrow; posterior short and broad; dorsal and ventral cirri widely divergent, bluntly conical, dorsal a little shorter than ventral. After the twenty-fifth foot a dorsal ramus appears (fig. 42), composed at first of a broad, thick, squarish plate, with a slight emargination near its upper margin, indicating its future division into lips; it contains from three to six straight aciculæ or setæ, usually concealed, sometimes projecting slightly; the dorsal cirrus becomes smaller; the other parts of the foot do not change much; further back the dorsal ramus is divided into two bluntly rounded lobes (fig. 43).

Anal cirri long, filiform.

Setæ of one kind only; in two bundles, upper and lower; upper most numerous; very long and slender; appendix nearly as long as the stem (fig. 44).

Body slightly convex above, flat below, anterior two-thirds of uniform width, tapering a little along the posterior third.

Color gray, slightly tinged with green.

Length, 25<sup>mm</sup>; width, 1.3<sup>mm</sup>.

The only specimen taken was a female filled with eggs; low water, mud.

Fam. THELETHUSIDÆ.

*ARENICOLA* Lamarck.

*ARENICOLA*? *CRISTATA* Stimpson.

STIMPSON. Proc. Boston Soc. Nat. Hist., vol. v, p. 114.

QUATREFAGES. Histoire Naturelle des Annelés, vol. iii, p. 673. 1865.

Only the anterior part of a single specimen was found. Probably belongs to Stimpson's species.

## Fam. CHLORÆMIDÆ.

TROPHONIA (*Aud. and M. Edw.*) *Claparède*.CLAPARÈDE. *Annél. Chét. du Golfe de Naples*, p. 105. 1868.TROPHONIA AFFINIS *Verrill*.*Siphonostomum affine* LEIDY. *Marine Invert. Fauna R. I. and N. J.*, p. 16. 1855.*Trophonia affinis* VERRILL. *Invert. An. Vin. Sound, etc.*, p. 605, pl. xiv, fig. 75. 1874.

This species is reported from Great Egg Harbor by Leidy, from Block Island and Buzzard's Bay by Verrill. We failed to find it.

## Fam. CHÆTOPTERIDÆ.

SPIOCHÆTOPTERUS (*Sars*) *Webster*.SARS. *Fauna Littoralis Norvegiæ. Seconde Livraison*, p. 7. 1856.WEBSTER. *Annél. Chæt. of the Virginian Coast*, p. 246. 1879.SPIOCHÆTOPTERUS OCULATUS *Webster*.

Annél. Chæt. of the Virginian Coast, p. 247, pl. viii, figs. 98-102. 1879.

Low water, sand; only a few specimens were taken.

## Fam. SPIONIDÆ.

NERINE (*Johnston*) *Sars*.NERINE AGILIS *Verrill*.

Invert. Animals of Vineyard Sound, etc., p. 600. 1874.

Prof. Verrill reports this species from the outer beach, burrowing in sand at low-water mark. We failed to find it.

SCOLECOLEPIS *Ble. 1828 (teste Malmgren)*.SCOLECOLEPIS VIRIDIS *Verrill*.

Invert. Animals of Vineyard Sound, etc., p. 600. 1874.

Our specimens do not agree in all respects with Verrill's description, and at first it seemed necessary to refer them to a new species; comparison with specimens received from him has established their identity. Verrill ascribes four eyes to *S. viridis*; our specimens have no eyes, as they were examined in this respect in the fresh state; the alcoholic specimens received from Prof. Verrill have no trace of eyes remaining, whatever their condition may have been while living. We found but one green specimen; the others were dark brown, or dark brown with a reddish or greenish tinge. There are from eight to ten anal papillæ (cirri), subulate, three to four times as long as the anal segment.

On one specimen the head and a few of the anterior segments had been lost and renewed, but the branchiæ were still wanting.

Common in sand at low water.

SCOLECOLEPIS TENUIS *Verrill*.

Invert. Animals of Vineyard Sound, etc., p. 601. 1874.

Reported by Verrill from Great Egg Harbor, in sand at low water. We failed to find it.

*SPIO* (*O. Fabr.*) *Ørsted.*

ØRSTED. *Annulorum Danicorum Conspectus*, p. 39. 1843.

*SPIO SETOSA* *Verrill.*

*Nerine coniocephala?* A. AGASSIZ. *Annals Lyceum Nat. Hist. of N. Y.*, vol. viii, p. 333, pl. x, figs. 39-45. 1866. (See Verrill, *op. cit.*)

*Spio setosa* VERRILL. *Invert. Animals of Vineyard Sound, etc.*, p. 602, pl. xiv, fig. 77 (copied from Agassiz.)

Verrill says of this species that the lateral lobes of the head are shorter than the median; this is true in alcoholic specimens; the reverse is the case in living forms. Common in sand at low water.

*POLYDORA* *Bosc.*

*Histoire Naturelle des Vers*, vol. i. 1802.

*POLYDORA HAMATA* *Webster.*

*Annel. Chæt. of the Virginian Coast*, p. 251, pl. viii, figs. 111-116, pl. ix, figs. 117, 118. 1879.

Common, living in galleries in shells. From low water to fifteen feet.

*POLYDORA LIGNI* *n. sp.*

PLATE V, FIGS. 45-47.

Head deeply emarginate in front, lateral lobes bluntly rounded (fig. 45), pointing forward and outward; lateral margins, in front and back of the eyes, concave; opposite the eyes (middle third) convex; a rounded carina runs back to the middle of the fourth segment; at the front margin of the third segment this carina bears a small conical papilla, always distinct, even on the smallest specimens.

Eyes four, black, circular, placed at the angles of a trapezoid; anterior pair larger than posterior.

Tentacles short, with the usual structure, colorless, without markings.

Dorsal cirri, long and stout on the anterior segments, smaller on those having branchiæ.

Branchiæ begin on seventh segment, long, finger-shaped, colorless, with red centre; they are found on all segments after the sixth, except a small but variable number of posterior segments.

Setæ of the fifth segment (fig. 46) eight to twelve in number, stout, apex bluntly rounded and slightly curved; a little below the apex is a small tooth on the side of the seta, forming a very small angle with the seta; dorsal setæ long, capillary, longer behind than in front; ventral setæ (fig. 47) short, bidentate; inner tooth very long, sharp, given off at right angles to the body of the seta; outer half covered by a membrane.

Terminal sucker broad, shallow, white; anal opening surrounded by low papillæ.

Body colorless, except as colored red or brownish-red by the blood and contents of the intestine; on either side of the carina a brown line, diverging in front, and passing to the outer base of the tentacles.

Length, 1-4<sup>mm</sup>; segments numerous.

Found on water-soaked wood, living in crevices, etc.

Tubes made of dirt, fragile, constructed with great rapidity.

STREBLOSPIO *n. gen.*

Head conical; proboscis incomplete above, divided below into two lobes along its anterior part. First segment prolonged laterally and below nearly to the front of the head; above carrying one pair of tentacles and one pair of branchiæ. Second segment with raised dorsal membrane, forming a pouch. Dorsal setæ capillary. Ventral setæ of first six segments like the dorsal, afterwards both uncinatæ and capillary. Anal segment simple, without appendages.

STREBLOSPIO BENEDICTI *n. sp.*

PLATE V, FIGS. 48-50.

Head, in extension, pointed, conical; posterior half somewhat compressed, sharply convex; anterior half slightly depressed.

Proboscis deficient above, below divided into two lobes for about one-half its length; these lobes are triangular at base, but (in extension) terminate, each in a short, finger-shaped process, covered with numerous long cilia. The first segment is about the length of the following segments, dorsally; at the sides and below it is prolonged, forming a kind of hood for the head. This hood or sheath originates as a thin, almost membraneous elevation of the sides of the segment, just within the dorsal setæ, passes forward external to the bases of the tentacular cirri and branchiæ, is prolonged to near the apex of the head, then curves suddenly downward, presenting a thin, free, anterior margin; laterally it is closely applied to the head, but rises above it, presenting a free, upper margin on each side; the head projects but very little beyond its hood. Dorsally the anterior margin of the first segment is concave, and carries a minute, conical, median papilla or cirrus.

Tentacular cirri (tentacles) have the same structure as in *POLYDORA*; turned backward they reach to the eighth or ninth segment.

Branchiæ behind and a little within the tentacles; reach back to the seventh or eighth segment; widest in the middle, tapering uniformly in both directions, except that near the top they are suddenly constricted, ending in a short cylindrical process; they are flattened below, carinate above, giving a triangular cross section for most of their length; edges thin, and thrown into deep, rounded folds or scollops. Both tentacles and branchiæ are densely covered with long cilia; turned forward they completely cover the head; the setæ of the first segment, both dorsal and ventral, are similar to those of the next five, but are a little shorter.

Second segment, covered dorsally by a raised membrane, forming a pouch; the free anterior margin of this pouch is deeply concave; its elevation above the dorsum equal to the thickness of the body; at the sides it passes into the dorsal cirri (lobes).

Dorsal cirri: back of each fascicle of dorsal setæ, on the first ten segments, is a broad, rounded plate or lobe; back of the tenth segment this plate gradually becomes narrower, until it is changed into a short, conical cirrus, which remains to the end.

Ventral cirri: on the first six segments behind each bunch of ventral setæ is a lobe similar to the dorsal lobe, but smaller; at the seventh segment it disappears.

Dorsal setæ, capillary; those on the anterior segments (fig. 48) wider and shorter than those further back (fig. 49); ten to fifteen in each fascicle in front, gradually decreasing in number till only four or five are found on the posterior segments; they are arranged along the lateral line of the dorsum, and point upward; the ventral setæ of the first six segments are similar to the dorsal, but less numerous, and a little shorter; back of the sixth segment the capillary setæ are nearly replaced by uncinate setæ—a few, however, remaining in the lower part of each series, even to the end; the uncini (fig. 50) are arranged in a single, transverse series, three to five in number, quite short, hardly projecting beyond the surface; they become gradually more numerous, each series having from eight to twelve on the posterior segments, at the same time growing a little longer; they have four terminal teeth, the outer one being shortest (fig. 50), and are covered by a delicate membrane.

Anal segment with slightly thickened, rounded margin; no appendages.

Body slightly convex above, flattened below.

Color: tentacles colorless; branchiæ dark green, with transverse bands of light green or yellowish-green; body colorless or light flesh-color; a few specimens with the first eight segments dark green.

Length of adult, 6<sup>mm</sup>; with, 0.6<sup>mm</sup>; number of segments, 70.

Found in great numbers on beds of *Mytilus edulis*; also in ditches to which the tide-water had access, very near high-water mark; the only other annelid found under the same circumstances being *Nereis limbata* EHLERS; the first specimen taken was on a shell, dredged. This species lives in dirt tubes, which they leave very readily when disturbed, and move about rapidly with quick, jerking motions of the body; they soon settle to the bottom, and immediately construct a new tube of any loose dirt that may be at hand.

The first part of the generic name is intended to recall their peculiar method of locomotion. The specific name is given in recognition of Mr. James E. Benedict, a sound and enthusiastic naturalist—my associate for the past two years in zoölogical work, who not only discovered the species in New Jersey, but has since found it at South Norwalk, Conn.

#### *Female.*

On one specimen the middle third of the dorsum was covered by a very thin, transparent, raised membrane. Unfortunately no figures of the young were made, and the notes are not full. They were broadly rounded in front and behind; sides convex; two small red eyes on the anterior margin of the head; lateral depressions indicating three segments; two circles of cilia, one just back of the head, the other near the posterior end.

### Fam. ARICIIDÆ.

#### ANTHOSTOMA *Schmarda*.

Neue Wirbellose Thiere, vol. i, part ii, p. 61. 1861.

#### ANTHOSTOMA FRAGILE *Verrill*.

VERRILL. Invert. Animals of Vineyard Sound, etc., p. 598. 1874.

WEBSTER. Annel. Chæt. of the Virginian Coast, p. 258. 1879.

The branchiæ may begin on any segment from the thirteenth to the twenty-first, according to the size of the specimen.

Common in sand at low water.

## Fam. CIRRHATULIDÆ.

CIRRHATULUS *Lamarck*.

Hist. Nat. des Animaux sans Vertèbres, vol. v, p. 300. 1838.

CIRRHATULUS GRANDIS *Verrill*.

VERRILL. Invert. An. Vin. Sound. etc., p. 606, pl. xv, figs. 80, 81. 1874.

WEBSTER. Annel. Chet. of the Virginian Coast, p. 258. 1879.

Rare; only one specimen was taken.

CIRRHINEREIS *Quatrefages*.

Histoire Naturelle des Annelés, vol. i, p. 462. 1865.

CIRRHINEREIS FRAGILIS *Qtrfg.*

*Cirrhatus fragilis* LEIDY. Marine Invert. Fauna R. I. and N. J., p. 15, pl. xi, figs. 39-43. 1855.

*Cirrhinereis fragilis* QUATREFAGES. Op. cit., vol. i, p. 464. 1865.

“ “ VERRILL. Op. cit., p. 607. 1874.

Rare; a single injured specimen was found which probably belongs to this species.

## Fam. CAPITELLIDÆ.

NOTOMASTUS *Sars*.

Reise i Lofoten og Finnmarken, p. 199. 1850.

Fauna Littoralis Norwegiæ, p. 12. 1856.

I have referred the following species to NOTOMASTUS *Sars*, although somewhat in doubt as to what constitutes a NOTOMASTUS. The following species of this genus and of the allied or identical genus ANCISTRIA have been reported from our coast: *Notomastus luridus* VERRILL, *Notomastus filiformis* VERRILL, *Ancistria acuta* VERRILL, *Ancistria capillaris* VERRILL and *Ancistria minima* QUATREFAGES (reported by Webster). It is quite certain that these five species belong to the same genus, but to what genus? Certainly to ANCISTRIA *Quatr.*, if it is a good genus. But Claparède says that ANCISTRIA is a synonym of CAPITELLA. But so far no one has seen the peculiar male sexual organs and setæ upon which so much stress is laid as characteristic of CAPITELLA. Prof. Verrill writes that he has never found them; I have never let a specimen pass without looking for these organs, but to no purpose. Accordingly, while our specimens belong to ANCISTRIA, they do not belong to CAPITELLA. It will be noticed that two of our species have been referred to NOTOMASTUS; and in fact they cannot be said to differ from NOTOMASTUS except in the length, and number of setæ, of the ventral rami. But Claparède, speaking of the “tores hamifères ventraux,” says (*Glanures*, p. 58): “Le développement extraordinaire des tores ventraux du côté dorsal est même le caractère essentiel des *Notomastus*,” according to which dictum not one of our species is a NOTOMASTUS, as they have not the elongated ventral rami and numerous setæ of the type species, *Notomastus latericeus* SARS. In regard to ARENIA *Quatr.*, Claparède (*Annel. Chet. du Golfe de N.*, p. 18) claims that is a NOTOMASTUS, and that the type species, *A. cruenta* QUATR., is *Capitella* (*Notomastus*) *rubicunda* KEFERSTEIN. In this case one must believe that Quatrefages entirely mistook the character of the posterior dorsal setæ, since he describes and figures them as capillary.



NOTOMASTUS FILIFORMIS *Verrill*.\*

PLATE V, FIGS. 51-54.

Invert. An. Vin. Sound, etc., p. 611. 1874.

Head very small, pointed, conical.

Proboscis apparently smooth; when magnified seen to be covered with minute papillæ.

First five setigerous segments with capillary setæ in both rami, not differing from each other, arranged in each ramus in a single transverse series, containing from eight to twelve setæ. After the fifth segment uncini only are found. At first the uncini are quite long (fig. 51), but few in the dorsal rami, from eight to twelve in the ventral; they grow progressively shorter backward (figs. 52, 53), and along the posterior third their number is much reduced, there being one to three in the dorsal rami, three to five in the ventral; a few of the posterior segments may be without setæ. The form of the uncini changes, as shown in the figures.

The anterior segments are biannulate, afterwards crossed by from three to five deeply impressed lines.

The anal segment is obliquely truncated; margin thickened and rounded (fig. 54); from its lower border projects a finger-shaped cirrus, which is distinctly annulated. (A similar cirrus exists on *N. luridus* VERR., *Ancistria minima* QUATR., and on several as yet unpublished species from Beaufort, N. C. I do not know that this cirrus has been previously described as belonging to this genus, or to any in the Family.)

Color: red to purplish-red in front; flesh-color to bright red behind.

Length very variable; greatest diameter of largest specimen 1.2<sup>mm</sup>.

Common; low water to fifteen feet.

NOTOMASTUS LURIDUS *Verrill*.

Invert. Animals of Vineyard Sound, etc., p. 610. 1874.

Rare; only one specimen was taken.

Young forms of *Notomastus*?

(a). One specimen, evidently immature, had capillary setæ only on the first four segments, then uncini only: but about the middle of the body the dorsal uncini were replaced by capillary setæ. Posterior segments lost.

(b). Another form, of which several specimens were found, had capillary setæ in all the dorsal rami, uncini in all the ventral. Length of (a) and (b) 10-20<sup>mm</sup>.

Found in shells bored by sponge; low water to fifteen feet.

Fam. MALDANIDÆ.

CLYMENELLA *Verrill*.

Invert. Animals of Vineyard Sound, p. 607. 1874.

CLYMENELLA TORQUATA *Verrill*.

*Clymene torquata* LEIDY. Marine Invert. Fauna R. I. and N. J., p. 14. 1855.

*Clymenella torquata* VERRILL. Op. Cit. p. 608, pl. xiv, figs. 71-73. 1874.

“ “ WEBSTER. Annel. Chaet. of the Virginian Coast, p. 258. 1879.

Very common in sand at low water.

\* I regarded this as a new species, and gave it the specific name of *lævis*; but on submitting specimens of the same form, taken at Provincetown, Mass., to Prof. Verrill, he referred them to his *N. filiformis*.

MALDANE (*Grube*) *Malmgren*.

GRUBE. Archiv für Naturgeschichte. 1860.

MALMGREN. Nordiska Hafs-Annulater, p. 186. 1865.

MALDANE ELONGATA *Verrill*.

VERRILL. Invert. Animals of Vineyard Sound, etc., p. 609. 1874.

WEBSTER. Annel. Chat. of the Virginian Coast, p. 259. 1879.

Rare; only one specimen was taken.

PRAXILLA *Malmgren*.

Nordiska Hafs-Annulater, p. 191. 1865.

In characterizing the genus PRAXILLA Malmgren assigns to it twenty-six segments, of which nineteen are setigerous, and five ante-anal without setæ. The following species belongs to Praxilla in all other respects, but has more than twenty-six segments, and less than five nude anti-anal segments.

PRAXILLA ELONGATA *n. sp.*

PLATE VI, FIGS. 55-59.

Buccal segment (fig. 55) with a projecting margin, slightly emarginate in the middle line above, and with a very narrow, hardly perceptible incision on each side, a little back of the middle. The cephalic plate has a well defined, median carina, widest in front, and with a flattened, slightly projecting portion, broadly rounded at the apex.

After the fifth segment the diameter increases gradually to the tenth; remains unchanged to the thirteenth; decreases gradually to the sixteenth; then falls off suddenly to about one-half the previous diameter, after which it remains unchanged.

Segments one, two, four, five and six have about the same length; three, seven, eight and nine are a little longer than the preceding; ten to fifteen about double the ninth; sixteen to thirty-six a little shorter than the fifteenth; last three equal to each other—together equal to the thirty-sixth (fig. 56).

The anterior margin of the fifth segment is raised and rounded, embracing the posterior end of the fourth. The first fifteen segments are nearly cylindrical, segmentation distinct, and crossed by numerous impressed lines; after the fifteenth the form suddenly changes, the anterior end being narrow, diameter increasing regularly to near the posterior end, then somewhat suddenly decreasing; the posterior margin of the ante-anal segment is raised, rounded, forming a sheath for the anterior end of the anal segment.

The anal segment is funnel-shaped; margin surrounded by a circle of conical or finger-shaped papillæ; very similar to the anal segment of *Clymenella torquata* VERRILL.

Setæ; dorsal (capillary) numerous, long, delicate, bilimbate (fig. 57); after the fifth segment there is a distinct, rounded papilla, or dorsal ramus, from which the setæ arise; ventral (uncini), on the first three setigerous segments only one, or occasionally two, to each ramus; these end in three sharp teeth

(fig. 58), of which two are very small; along the inner two-thirds are numerous longitudinal striæ, interrupted by transverse striæ, unequally distant from each other; at the fourth setigerous segment the number of uncini increases suddenly to ten or fifteen in each series, and the form also changes (fig. 59); they have now five terminal teeth, a short, external part is quite narrow, and divided from the stouter, internal part by a deep constriction, simulating a compound seta; the thirty-seventh segment has only the dorsal setæ; to the tenth segment the setæ are found in the middle of each segment; after the tenth they suddenly recede to near the posterior end.

Three specimens were collected—one perfect, the others with anterior part only; and of these only one, having the ten anterior segments, was observed while living; its general color was yellowish-white, with narrow, red bands on the posterior part of each segment after the fourth, increasing gradually in width so as to occupy one-half the length of the tenth segment; indications of similar bands can be traced on the entire specimen, in alcohol, but not after the tenth segment.

Length of entire specimen, 95<sup>mm</sup>; greatest diameter, 3<sup>mm</sup>; diameter of buccal segment, 2<sup>mm</sup>.

Number of segments, 39; buccal (coalesced with the cephalic), 1; setigerous, 36; ante-anal, nude, 1; anal, 1.

Rare; found in sand at low water, associated with *Clymenella torquata* VERRILL.

PRAXILLA ELONGATA var. BENEDICTI Webs.

PLATE VI, FIGS. 60, 61.

Mr. J. E. Benedict found at south Norwalk, Conn., a variety of this species, differing from the form just described in the following particulars:

First two segments short (fig. 60), together about equal to the third; after the fifteenth segment the diameter suddenly becomes less, segments short, and, except the last four, equal. (Compare the first segment of fig. 61 with the first of fig. 56.) The ante-anal segments (fig. 61), quite short, together equal to the anal; anal cirri longer than in the New Jersey form.

Length of an entire specimen, 20<sup>mm</sup>; number of segments, 37.

A young specimen had twenty-six segments, with a length of 3<sup>mm</sup>.

PARAXIOTHEA n. gen.

No cephalic plate.

Anterior margin of first segment prolonged as a thin membrane, emarginate above, and with a slightly projecting conical process in the middle line below.

Mouth situated on the lower surface of a conical process, arising from the bottom of the cylindrical cavity enclosed by the frontal membrane, not reaching to the front margin of the membrane. First segment with capillary and unciniate setæ, similar to those on the remaining segments.

Anal segment funnel-shaped; margin digitate.

PARAXIOTHEA LATENS n. sp.

PLATE VII, FIGS. 62-66.

Frontal membrane (figs. 62, 63) forming one-half the length of the first segment; anterior margin slightly reflexed, lobed or scalloped by shallow incisions,

which are continued as impressed lines for some distance, on both the outer and inner surface of the membrane; superior emargination broad but shallow.

First segment a little longer than the second, about equal to the sixth; second, third and fourth equal; fifth a little shorter; segments six to ten grow progressively longer, but so gradually that the change is hardly perceptible; eleven to thirteen also gain in length progressively, but rapidly, the thirteenth having double the length of the tenth; fourteenth, fifteenth and sixteenth about equal to the tenth; seventeenth and eighteenth short, equal, together about equal to the sixteenth, a trifle longer than the anal.

Diameter of first segment a little less than that of the second; uniform from second to tenth inclusive; falling off about one-third at the eleventh, after which the decrease is very slight.

One ante-anal nude segment (fig. 64) with thickened, rounded, posterior margin, forming a collar around the front end of the anal segment.

Anal segment with numerous, short, unequal cirri or digitations, quite similar to *Clymenella torquata* VERRILL, or *Prorulla elongata* WEBSTER.

The dorsal (capillary) setæ (fig. 65) are long, delicate, numerous, with a single thin margin. The uncini have the same form on all the segments (fig. 66); they have five sharp terminal teeth, of which three are small and equal; the fourth longer and larger than the third; the fifth, double the size of the fourth. On the first three segments there are from fifteen to twenty uncini in each series; after the third, from twenty to twenty-five, except on a few of the posterior segments, where there is a smaller number. The first five segments have the setæ on the middle line, and a deeply impressed ventral line connects the series of uncini on each segment. After the fifth segment the setæ are near the posterior end, and after the tenth the dorsal rami (*tori uncinigeri*) are quite large, making the segments somewhat club-shaped.

Number of segments, 19; of these 17 are setigerous; one ante-anal, nude; one anal.

Color (in alcohol) yellowish-white; on one specimen broad bands of umber-brown cross the ventral surface, dividing at the uncini, giving a narrow band on each side of each series of uncini after the fifth.

At Great Egg Harbor we obtained two specimens, both of which had lost their posterior segments. The longest has fifteen segments, with a length of 65<sup>mm</sup>; greatest diameter 3<sup>mm</sup>. The description was completed from a single perfect specimen, collected by Mr. James E. Benedict at South Norwalk, Conn., during the same summer.

Length of entire specimen, 46<sup>mm</sup>; greatest diameter, 3<sup>mm</sup>.

Found at low water in sand, associated with *Clymenella torquata* VERRILL.

### Fam. HERMELLIDÆ.

#### SABELLARIA Lamarck.

#### SABELLARIA VARIANS Webster.

Annel. Chet. of the Virginian Coast, p. 259, pl. ix, figs. 133-136: pl. x, figs. 137-139. 1879.

Prof. Verrill has described a species of SABELLARIA (*S. vulgaris*) from Great Egg Harbor, and in the proceedings of the Academy of Natural Sciences

of Phila. for 1878, p. 300, mentions that he has also received the same form from Beaufort, N. C. After careful comparison of numerous specimens from New Jersey, Virginia, and North Carolina, I have found it impossible to refer any of them to his species. It will be necessary to compare type specimens of the two forms.

## Fam. AMPHICTENIDÆ.

### CISTENIDES *Malmgren.*

Nordiska Hafs-Amnulator, p. 358. 1865.

### CISTENIDES GOULDII *Verrill.*

*Pectinaria Belgica* GOULD. Invertebrata of Mass., 1st ed., p. 7, pl. i, fig. 1. 1841.

*Pectinaria auricoma* LEIDY. Marine Invert. Fauna R. I. and N. J., p. 14. 1855.

*Cistenides Gouldii* VERRILL. Invert. An. of Vineyard Sound, etc., p. 612, pl. xvii, figs. 87, 87a. 1874.

Common at low water. One very large specimen was taken; length, 50<sup>mm</sup>; diameter, 9<sup>mm</sup>; length of tube, 80<sup>mm</sup>. The color of all our specimens was yellowish-white, save as colored red by the blood showing through.

## Fam. AMPHARETIDÆ.

### SABELLIDES (*M. Edw.*) *Malmgren.*

The following species agree with *SABELLIDES Mgrn.*, except that the uncini begin on the third setigerous segment instead of the fourth, and that the first ramus, though smaller than the second, is not very small:

### SABELLIDES OCLATA *n. sp.*

PLATE VII, FIGS. 67-69.

On the middle line of the head two minute eye specks, black, lateral.

Cirri numerous, light flesh-color.

Anal cirri short, obtuse.

Branchiæ delicate, reaching back to the ninth or tenth segment.

Capillary setæ, some (fig. 67), with a single, narrow margin; others (fig. 68) bilimbate. Uncini begin on the third setigerous segment; fourteen posterior segments with uncini only; they have five sharp teeth (fig. 69).

Branchiæ green with dark green center; head white; body flesh-color.

Length, 18-20<sup>mm</sup>.

Dredged, fifteen feet, shelly bottom.

## Fam. TERESELLIDÆ.

### AMPHITRITE (*Müller*) *Malmgren.*

MALMGREN. Nordiska Hafs-Amnulator, p. 374. 1865.

### AMPHITRITE ORNATA *Verrill.*

*Terebella ornata* LEIDY. Marine Invert. Fauna, R. I. and N. J., p. 14, pl. xi, figs. 44, 45. 1855.

*Amphitrite ornata* VERRILL. Invert. An. Vin. Sound, p. 613, pl. xvi, fig. 82. 1874.

" " WEBSTER. Annel. Chæt. of the Virginian Coast, p. 262. 1879.

Very abundant at low water; sand and mud.

SCIONOPSIS *Verrill*.

Invert. Animals of Vineyard Sound, p. 614. 1874.

SCIONOPSIS PALMATA *Verrill*.

VERRILL. Op. cit., p. 614. 1874.

WEBSTER. Op. cit., p. 262. 1879.

Common ; dredged ten to fifteen feet.

POLYCIRRUS (*Grube*) *Malmgren*.

MALMGREN. Nordiska Hafs-Annulater, p. 393. 1865.

POLYCIRRUS EXIMIUS *Verrill*.

*Torquea eximea* LEIDY. Marine Invert. Fauna of R. I. and N. J., p. 14, pl. xi, figs. 51, 52. 1855.

*Polycirrus eximius* VERRILL. Invert. An. Vin. Sound, p. 616, pl. xvi, fig. 85, 1874.

“ “ WEBSTER. Annul. Chæt. of the Virginian Coast, p. 263. 1879.

Common on shells, etc. ; dredged.

## Fam. SABELLIDÆ.

SABELLA (*L.*) *Malmgren*.

MALMGREN. Nordiska Hafs-Annulater, p. 398. 1865.

SABELLA MICROPHTHALMA *Verrill*.

VERRILL. Op. cit., p. 618. 1874.

WEBSTER. Op. cit., p. 265. 1879.

Quite common.

## Fam. SERPULIDÆ.

HYDROIDES *Gunnerus*. (1768.)HYDROIDES DIANTHUS *Verrill*.

*Serpula dianthus* VERRILL. Op. cit., p. 620. 1874.

*Hydroides dianthus* VERRILL. Proc. Acad. Nat. Sci., Phila. for 1878, p. 300.

“ “ WEBSTER. Annul. Chæt. of the Virginian Coast, p. 266. 1879.

Common on rocks and shells, from low water to fifteen feet.

UNION COLLEGE, SCHENECTADY, N. Y., }  
December, 1878.

DESCRIPTION OF NEW SPECIES OF FOSSILS  
FROM THE CALCIFEROUS FORMATION.\*

By C. D. WALCOTT.

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PLATYCERAS *Conrad*, 1840.

PLATYCERAS MINUTISSIMUM *Walcott*.

Shell small, subspiral, regularly arcuate from near the aperture to the apex, making nearly three-fourths of one revolution; section subelliptical, somewhat earinate upon the dorsum. Two transverse depressions upon the sides, give a slight undulation to the body of the shell.

Surface marked by faint longitudinal striae.

*Formation and locality.* Calciferous formation, Saratoga Co., N. Y.

METOPTOMA *Phillips*, 1836.

METOPTOMA CORNUTAFORME *Walcott*.

Oval, subconical; apex incurved, depressed, extending beyond the anterior margin; distance from the posterior margin to the apex twice the width. The most elevated point is about two-thirds the distance from the posterior margin to the apex; from this point the outline curves regularly to the posterior margin and anteriorly to the apex. Outline from the apex to the anterior margin convex. Length, nine lines; width, four and one-half lines.

Surface, with narrow concentric ribs, one-half a line apart; finely striate vertically.

*Formation and locality.* Calciferous formation, Saratoga Co., N. Y.

CONOCEPHALITES *Zenker*, 1833.

CONOCEPHALITES CALCIFEROUS *Walcott*.

Head semicircular, convex. Glabella truncate-conical, moderately convex; width at the base nearly equal to the length; anterior margin straight, abruptly rounded at the angles; sides straight and regularly converging; the posterior and middle glabellar furrows oblique and well marked, the anterior furrow indicated by a smooth line upon the granulose outer shell, and a slight depression when the outer shell is removed. Occipital furrow broad and well impressed. Occipital ring narrow at the sides, widening at the centre to form the base of a strong slightly curved spine, which extends obliquely backward;

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\* Advance copies of this paper were printed January 3, 1879.

the length of the spine in large individuals equals the length of the head. The glabella in very young individuals is more convex, the glabellar furrows more strongly impressed, and the spine projecting from the occipital ring shorter, and less obliquely inclined backward. Dorsal furrows equally impressed at the sides and front of the glabella. Facial suture, curving slightly outward from the frontal margin, passes directly to the anterior angles of the palpebral lobe opposite the anterior glabellar furrow, thence curving to the posterior angle of the palpebral lobe, it extends obliquely outward to the lateral margin of the posterior limb.

Fixed cheeks narrow; frontal limb extending equal to one-half the length of the glabella, sloping somewhat abruptly to a comparatively broad, thickened margin; posterior limb narrow, elongate, with a strongly defined furrow along the center. Palpebral lobe separated from the fixed cheeks by a sigmoid groove, which unites anteriorly with the dorsal furrow. Surface of glabella and fixed cheeks granulose; on the frontal limb the granules are so arranged as to give the appearance of lines running from the dorsal furrow to the broad margin, which has lamellose striæ subparallel to the margin. The largest head obtained of this species is ten lines in length, with a spine of equal length projecting from the occipital ring.

*Formation and locality.* Calciferous formation, Saratoga Co., N. Y.

#### CONOCEPHALITES HARTTI *Walcott.*

Glabella truncate-conical, moderately convex; width at base, excluding occipital segment, equal to the length; slightly rounded in front, with anterior lateral angles abruptly rounded; posterior glabellar furrow extends obliquely in about one-third the distance across the glabella from each side, where it is united by a transverse furrow; middle furrow extends obliquely in from each side, but is not united at the center; anterior furrow obscurely defined opposite the anterior angle of the palpebral lobe. Occipital furrow broad and not deeply impressed. Occipital ring broad and slightly convex. Dorsal furrow well defined at the sides and front.

Facial suture curves slightly outward from the frontal margin, thence curving in to the anterior angle of the palpebral lobe, passes to the posterior angle of the palpebral lobe, and thence obliquely outward to the margin of the posterior limb.

Fixed cheeks comparatively broad; frontal limb about one-fifth the length of the head, curving gently from the dorsal furrow to the anterior margin; posterior limb elongate, with a strong furrow from the dorsal furrow to its extremity. Palpebral lobe elongate, separated from the fixed cheeks by a groove within the margin; surface covered with fine lamellose striæ.

This species is much larger than *C. calciferus*; the head described measures seventeen lines in length by twenty-eight lines in breadth at the extremities of the posterior limb.

*Formation and locality.* Calciferous formation, Saratoga Co., N. Y.



PTYCHASPIS *Hall*, 1863.PTYCHASPIS SPECIOSUS *Walcott*.

Glabella large, very convex, almost subcylindrical, width a little less than the length, nearly straight in front, the lateral angles rounded, sides straight and nearly parallel; posterior glabellar furrow extending deeply and obliquely about one-third across the glabella and connected by a straight transverse furrow; the middle glabellar furrow is less deeply impressed and extends across the glabella subparallel to the posterior furrow; the anterior furrow is indicated by a very obscure line opposite the anterior angle of the palpebral lobe. The occipital furrow is deeply impressed throughout its length. The occipital ring is strong and prominent, but not elevated above the general surface of the glabella. Dorsal furrow deeply excavated at the sides and well defined in front.

Facial suture, cutting the frontal margin on a line with the outer edge of the palpebral lobe, curves slightly outward, and passes directly to the anterior angle of the palpebral lobe, curving around this it passes obliquely outward to the margin of the posterior limb.

Fixed cheeks of medium width; the frontal limb is impressed with a groove midway between the dorsal furrow and its anterior margin; the posterior limb is subtriangular, with a furrow extending from the dorsal furrow to its lateral margin; the palpebral lobe is large and separated from the fixed cheeks by a deep sigmoid furrow. Surface granulose with waving striæ on the central portion of the fixed cheeks opposite the palpebral lobes.

This species is referred to the genus *PTYCHASPIS* from its strongly furrowed subcylindrical glabella and the direction of the facial suture. The largest specimen obtained of the head has a length of six lines, with a breadth of seven lines at the palpebral lobes.

*Formation and locality.* Calciferous formation, Saratoga Co., N. Y.

BATHYURAS ARMATUS *Billings*.

Mr. Billings described\* the type of this species from the Levis formation of the Quebec group. A form closely related occurs in the Calciferous formation of Saratoga county, and may prove to be the same. A comparison with the type will be necessary to separate them, as the specimen figured was in poor condition and not well illustrated, if the description was taken from it.

The above described species are associated with *Stromatopora* sp.?, *Lingula acuminata*, *Metoptoma simplex*, *Murchisonia* sp.?, a lamellibranchiate shell, and two forms too imperfect for determination.

The occurrence of a species of the genus *PTYCHASPIS* associated with *Conocephalites calciferous* and *C. Hartti*—species related to *C. Wisconsinensis* and *C. Iowensis* of the Potsdam fauna of Iowa and Wisconsin, relates the fauna of the Calciferous formation of New York with that of the Potsdam sandstone of Iowa and Wisconsin.

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\* Palæozoic Fossils, vol. i, p. 411.



## LAURENTIAN MAGNETIC IRON ORE DEPOSITS IN NORTHERN NEW YORK.

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TO PROF. JAMES HALL, *Director of the New York State Museum of Natural History, Albany, N. Y.:*

SIR—For several years past the subject of the Laurentian Magnetic Iron Ore Deposits in Northern New York has occupied my attention. My intention in the following pages is merely to state a few facts which have come to my notice, and for the present reserve a longer and more detailed report.

I have not been able, from any of the reports on the geology of New York, to draw any general conclusions with reference to the geological structure of the district under consideration; indeed, this seems still to be an exceedingly complicated question. I shall endeavor to explain what I have seen, and possibly aid others in their researches.

The Laurentian of Canada has been divided by Sir W. E. Logan into the Lower Laurentian, and the Upper Laurentian or Labrador Series. In the Canadian reports we find that the Upper Laurentian is acknowledged to rest unconformably upon the Lower Laurentian. We have in Northern New York these two groups of rocks characterized by their mineralogical peculiarities, and we have proof of their unconformity. There are, however, several series of rocks in the eastern portion of the Adirondack region, or that portion bordering Lake Champlain, in the townships of Moriah, Crown Point, and Ticonderoga, which undoubtedly deserve separate consideration.

The Lower Laurentian, or that series containing the workable beds of magnetic ore, is without doubt the lowest of the series exposed in this region. Its area and distribution I have, from the first of my work, endeavored to trace, as it is of the utmost economic value. My data for the present are based on limited observations at various times during the last four years, and not extending over any very great area, being confined to Essex county, and particularly to a few of the townships of that county. Some facts which I have been able to establish may, in time, lead to the completion of a geological map and a solution of the geological structure.

The mountains throughout the eastern portion of Essex county lie in ranges extending in a northeast and southwest direction, and indicate lines of upheaval.

The following streams indicate in a general manner the direction of the uplifts: the east and west branches of the Ausable river and Boquet, the Black river, draining to the northeast, and the Upper Hudson river, Boreas river, Schroon river, flowing to the south.

These streams may be divided in the following manner: the west branch of the Ausable river, from Wilmington southwestward through North Elba and its head waters into the Indian Pass, forms a general northeast and southwest line with the course of the Upper Hudson, originating in the Indian Pass and flowing southward through Lake Henderson, Lake Sanford, and continuing in an almost due-southward direction as far as Tahawus. Along this line are the abrupt mountains, "White Face" and "Wall Face."

The eastern branch of the Ausable extends from Ausable Forks southward and a little west through Upper Jay, Keene, Keene Flats, and southward by

South of the mines along the line of Mill brook, extending from Port Henry to the neighborhood of Ensign pond, we find the Laurentian limestone group with its rusty, decomposing, syenitic rocks and some sulphury ores. This limestone is undoubtedly a newer series than that of the Mineville rocks, being clearly proven to rest unconformably upon the Lower Laurentian rocks of the Cheever Ore Bed, from which neighborhood it extends along the lake to Port Henry, thence westward to vicinity of Ensign pond. It encircles the end of the lake range, of which Bald Peak is the highest mountain, north of Port Henry.

The dips of the limestone group are more gentle, as a rule, than in the lower division, and, as a whole, it has the appearance of having been deposited secondary to the Lower Laurentian, and unconformably upon it.

The southern and southwestern portions of the township of Moriah are occupied by a series which bears a doubtful relation to the magnetic ore ranges, but is apparently intimately in connection with the limestone group. In some portions it resembles the quartzites of the Lower Laurentian, and in others it resembles more closely the light-colored garnetiferous rocks, which form a portion of the lake range in the southern and eastern quarters of the township of Westport, and belong to the Labrador series. The succession is, however, very different, and it is therefore impossible to identify them as the same. This group is undoubtedly a continuation of the thinly bedded quartzites and syenitic rocks which extend southward through Crown Point into Ticonderoga, where there are numerous deposits of sulphury iron ores and plumbago.

This group is characterized by its numerous Trap Dykes, apparently more frequent in the vicinity of the limestone, though this frequency may be due to the contrast in the rate of disintegration—the limestone leaving the trap rock more boldly exposed.

The line of junction between the two groups—the Lower Laurentian containing the large deposits of magnetic iron ore, and the crystalline limestones with the succession of quartzose rocks and garnetiferous gneisses—is not clearly seen at any point. The reason of this is that along such lines of junction the action of the weather has had fuller force, and the decomposition and disintegration has been more rapid, thus forming deep depressions and valleys which have recently been filled by the glacial debris swept into them by the moving ice.

The limestone group, with its various associated rocks, may be said to occupy the entire southern half of the township of Moriah, extending northward to the general line of Mill brook from Ensign pond to Moriah Center, and from thence in an easterly direction to the lake, and bordering the lake as far north as the Cheever Ore Bed.

The limestone is overlaid in many places along the lake by the Potsdam sandstone, which is well exposed at and above Port Henry; there are also fine exposures of it in the northeastern corner of the township.

The actual junction or overlapping of the Potsdam sandstone or quartzite on the gneiss and limestone is nowhere to be seen. The reason is that the limestones disintegrate so rapidly that the sandstone becomes undermined, and breaking off, covers up the junction.

The limestone along the lake extends westward to the base of the high range which rises about 3,000 feet, in Bald Peak mountain, above the lake. The rocks of this range, as far as my observations carry me, pitch to the westward within this township, and probably belong to the Lower Laurentian, though they have not been proven to contain any large deposits of magnetic ore.

I would remark here that this range has never been carefully studied; but I hope to complete the township map now in progress, and prove the relations of

this range to the Labradorite series which forms the lake range in the township of Westport (north of Moriah), and probably extends to the line of Mullen brook, which cuts through a marked depression just north of Bald Peak mountain. This depression extends around the northern boundary of this mountain to the neighborhood of Barton pond.

There is a large area extending from the vicinity of Barton pond southward to Moriah Corners and south of this point, which is covered principally with glacial debris, varying from fifty to three hundred feet in depth.

Bald Peak mountain, together with the range of iron-ore-bearing rocks at and about Mineville, seem to have been brought up by faults.

The northern portion of the township of Moriah is occupied by the Lower Laurentian rocks, containing large deposits at various places of magnetite iron ore. The central portion of the township along the line of Mill brook is occupied by the limestones of the Laurentian, deposited unconformably on the Lower Laurentian, and the entire southern portion is occupied by the garnetiferous micaceous gneisses and quartzites, with numerous beds of sulphury and lean iron ores.

### ELIZABETHTOWN.

#### LOWER LAURENTIAN.

The Lower Laurentian rocks of this township probably extend across the entire southern end, at least as far as the Boquet river, and thence to the neighborhood of New Russia and across in an easterly direction to the township of Westport. How far to the westward of the Boquet river this formation extends, I am as yet unable to say.

The region east and southeast of the Black river is undoubtedly a monoclinical pitching to the westward. As yet I have no evidence of a synclinal structure. There are no developments of iron ore beds through this region, though there are beds of Magnetite in the neighborhood of Long pond, which may be in close geological proximity to those of the Fisher Hill mines.

The region between the Black and Bouquet rivers has been proven to be synclinal; along the Black river the rocks and ore beds pitch to the westward and northwest, and along the right bank of the Boquet the rocks pitch to the eastward. It is highly probable that the same lower rocks pitch to the westward west of the Boquet river overlaid by the Labradorites, reappearing again in an anticlinal fold along which the Ausable river flows through Keene.

It is, therefore, probable that nearly all of the territory west of the Boquet river in this township belongs to the Labradorite series. That the portion of the township lying north of an east and west line from the neighborhood of the Kingdom Forges to the Boquet river belongs to this upper series, is beyond a doubt.

In lot 209 of the "Iron Ore Tract," situated southeast of the town of Elizabethtown, there has been developed a bed of Titaniferous iron ore, which is characteristic of the Upper Laurentian or Labradorite series. The true line of junction of the Labradorite series with the Lower Laurentian rocks is probably not far south of this point, and the outlet of Little pond flowing westward to the Boquet river may be the true line of junction. The general structure here is an eroded synclinal with northeast and southwest axis overlapped by the Labradorite series pitching westward.

### WESTPORT.

#### LOWER LAURENTIAN.

The Magnetite range of the township of Moriah and Elizabethtown continues across the township lines and extends into the township of Westport, occupying

probably the entire southwestern corner of the township—that is to say, an area commencing at the southwest corner near or at Fletcherville east to the line of Mullen brook, thence northward to the north of Nichols' pond and west to the township line. The old workings of Campbell Hill are located in the vicinity of this pond on lots 168 and 166. With the exception of this area and probably a small area south of Mullen brook, Westport is occupied by the Labradorite series, except that portion covered by the Cambrian limestones along the lake.

The entire eastern two-thirds of the "Iron Ore Tract" has been carefully studied, and nowhere are other rocks to be found than those belonging to the Labradorite series. The general pitch of these rocks, here forming the lake range, is to the northward as far as the northern boundary of the tract or a line east and west through the village of Westport.

The general structure of the northern half of the township is not settled, but we know that along the northern shore of the Westport bay we have the same Upper Laurentian series pitching to the southward. A great deal of the northern portion of this township is concealed by glacial debris and Champlain clays. Split Rock mountain occupies the northwestern portion of this township, and extends northwestward into the township of Essex. Titaniferous iron ore has been mined on this mountain. Along the lake shore, from the village of Westport to the Moriah township line, the Cambrian limestones occur everywhere. They are also exposed in place not far from the eastern boundary of the Iron Ore Tract, near and at the base of the lake range.

The region between the Iron Ore Tract and the lake is covered by the blue Champlain clay, which has been deposited principally on the limestones, but occasionally extending into bays and resting on the gneisses. At the village of Westport, the Potsdam sandstone makes its appearance in the bed of the brook. There are beautiful exhibitions of glacial action and glacial moraines in many parts of this township.

## ESSEX, WILLSBOROUGH, LEWIS AND CHESTERFIELD.

These townships I have not been able to study, except in a very superficial manner. They are, however, occupied principally by the Upper Laurentian series as far as my observations carry me.

In the southwest corner of Chesterfield township, there is an outcrop of Titaniferous iron ore, and also large deposits of crystalline limestone containing much plumbago. Along the lake shore the Cambrian limestones occur in many places, capped by the Champlain clays and sands. At Keeseville, the Ausable river cuts through the Potsdam sandstone in a deep gorge or chasm, celebrated for its picturesque scenery.

### CROWN POINT.

#### LOWER LAURENTIAN.

The area occupied by this group is comparatively small. It is situated in the western part of the township, bounded on the north and west by a stream flowing into Paradox lake; its southern and eastern boundary I have not as yet determined. Hammondville is probably located about the center of the area. There are large deposits of magnetic iron ore developed at this point.

The geological structure is exceedingly complicated. The probability is that it is an uplift cut off on the north and west by a fault, with an eastward pitch complicated by minor folds, faults and contortions. Crystalline limestone flanks it on the north and west. To the east it is followed by a series very similar, and probably identical, with that associated with the limestones of Moriah township.

This formation, with its sulphury ore, occupies the major part of the township. Crystalline limestone occurs northwest of Irondale, and the enormous escarpment extending through the central portion of the township to the lake may be due to the rapid erosion of limestone beds. This may never be proven, as the Champlain clays and sands extend a long distance back from the lake, concealing everything from view. One of the most interesting quartz and feldspar veins I have ever seen occurs in the northern-central portion of this township. Crown Point itself is formed by the Cambrian limestones capped by Champlain clays.

### TICONDEROGA.

There is very little information on this township in my possession. All I can say at present is, that all the rocks I have seen convince me that the series belong to that of eastern Crown Point and southern Moriah. It abounds in beds of sulphury iron ore and large deposits of crystalline limestone with plumbago. The rocks are, many of them, thinly bedded quartzites and hornblende syenites.

I am indebted to Mr. William H. Case, C. E., of Port Henry, for information concerning a deposit of crystalline limestone capped by Potsdam sandstone, in the west-central part of the township, near Putnam's pond, lot 179 of Stoughton and McClellan's tract; also of a glacial moraine in the same vicinity.

The presence of Potsdam sandstone at this elevated point, and so far from the lakes, would rather indicate that there have been great disturbances since the deposition of this formation. The Cambrian limestones are to be seen at Fort Ticonderoga, and also extend along the lake front.

Lake George owes its origin to a dam of glacial debris capped by Champlain clays, across the northern end of a valley extending into Warren county. It is possible that the lake is really formed by two valleys—the summit being at the Thousand Islands—the one having its pre-glacial outlet to the north, the other to the south. I am informed the Potsdam sandstone occurs in many places along the lake.

### SCHROON AND MINERVA.

I am satisfied that the township of Schroon is occupied by the Labradorites and the crystalline limestones with the associated gneisses.

The limestone occurs along Paradox lake and extends into the township of Crown Point, along the line of the brook which forms the north and the west boundary of the Lower Laurentian rocks of Hammondville. Undoubtedly this crystalline limestone extends southward further than it has yet been traced. It occurs just west of the village of Schroon Lake. In the western portion of the township the rocks have a similar aspect to those in Ticonderoga, and I have reason for classing them with those of that region. At Schroon Lake village the Chazy limestone occurs with fossils. The outcrops are not extensive, being covered by a sand and clay deposits. The southern portion of Minerva township is occupied principally by the crystalline limestones with the associated gneisses.

The lower Laurentian makes its appearance in a bold mountain, in the east-central portion of the township. The Rosenkranz mine is located here. The "Thorn's survey" probably includes nearly all of this uplift. It is flanked on the southeast, south and west by crystalline limestones. As for the western and northern portion of the township, I have no data, but the rocks belong undoubtedly to the Labradorite and the Limestone series.

## NORTH HUDSON AND NEWCOMB.

I have not studied this region, but from the few observations I have made and facts I have gathered, there is no doubt that the entire region may be considered as belonging to the Labradorite series, with limestones probably of the same group as those in Minerva township. The iron ores which have been developed in Newcomb are all titaniferous.

As for the remaining townships, I would merely state that there are not facts enough as yet collected to make it worth while to theorize. Magnetite has been reported found at many places. Magnetic iron occurs at Long or Edmond's pond, in Keene township. It has also been found in the neighborhood or along the east branch of the Ausable river. Whether this river flows along an eroded anticlinal fold or not remains to be proved.

North Elba, St. Armand and Wilmington townships are undoubtedly occupied by the Labrador series.

Since the above was written, I have learned sufficiently of the relations of the crystalline limestone to state that it rests unconformably upon the Upper Laurentian rocks; and the entire group of crystalline limestones, with its associated decomposing gneisses, will probably be proven to be a newer series of rocks resting unconformably upon the Lower and Upper Laurentian.

I had hoped to have some maps of the iron-ore mines, but they are not ready for publication.

The accompanying map is subject to many alterations, and is only preliminary. Without doubt, further investigation will change the present assumed areas.

I am yours very respectfully,

CHARLES E. HALL,

*Assistant to the Second Geological Survey of Penn.*

PHILADELPHIA, October —, 1879.



# CORALS AND BRYOZOANS OF THE LOWER HELDERBERG GROUP.

By JAMES HALL.

AN ENUMERATION AND DESCRIPTION OF THE CORALS AND BRYOZOANS OF THE LOWER HELDERBERG GROUP; WITH REFERENCES TO THE PLATES AND FIGURES OF SPECIES IN VOL. VI, PALÆONTOLOGY OF NEW YORK—UNPUBLISHED.

In the *Twenty-sixth Report on the New York State Museum of Natural History*, the writer communicated a paper on the "*Bryozoa and Corals of the Lower Helderberg Group*." This paper was published in pamphlet form, in May, 1874, and in the full Report in July of the same year. In 1877 it became necessary to prepare the drawings of these subjects for the Palæontology of the State. In commencing this work, it soon became apparent that the previous publication was very incomplete, and that a careful revision would be required for many of those species already described. After a study of the entire group of species, with special instruction given to Mr. Simpson, the draughtsman of the work, I committed them to his care. The species have been critically studied by him, and the drawings have been made with a knowledge of the structure and characters of the fossils. The plates have been lithographed in a very satisfactory manner preparatory to the final publication.

The results of more recent studies made upon the former collections, and upon others subsequently obtained, have rendered it necessary to modify the expressions regarding some of the species previously described, and to designate a considerable number of new species. The revision of the previous paper, together with the descriptions of the new species here included, give an expression of our knowledge of these groups of fossils, up to 1878.

In the enumeration of the species, I have considered it advisable to make reference to the numbers of the plates and figures, as already arranged and lithographed for the volume of the Palæontology which will contain the final descriptions.

\* \* The fossils included in this enumeration are designated as Corals and Bryozoans—the line of demarcation between the two classes, in the genera CHÆTETES, TREMATOPORA and CALLOPORA being at the present time not satisfactorily determined.

STREPTELASMA, *Hall.*

## STREPTELASMA STRICTA.

(PLATE I, FIGS. 1-10.)

*Streptelasma (Petraia) stricta*, HALL. Twenty-sixth Rep. N. Y. State Museum of Nat. Hist., p. 114. 1874.

ZAPHRENTIS, *Raf.*

## ZAPHRENTIS RÆMERI.

(PLATE I, FIGS. 11-21.)

*Zaphrentis Ræmeri*, EDWARDS & HAIME. Monog. des Polyptiers Fossiles. Paris. 1851.

AULOPORA, *Goldf.*

## AULOPORA SCHOHARIÆ.

(PLATE II, FIGS. 1-6.)

*Aulopora Schohariæ*, HALL. Twenty-sixth Rep. N. Y. State Mus. Nat. Hist., p. 110. 1874.

Corallum consisting of elongate, tubular cells, gradually enlarging to the aperture, transversely corrugated, longitudinally striated; increasing sometimes by one tube budding in a direct line from the basal part of another; at others two buds rising at an angle of about 45° from the parent tube. All the tubes, after budding, assume an erect position and cease growth. Diameter of cell-tubes, at apertures, a little more than one mm.; length from five to seven mm.

This species is much smaller than that in the Hamilton group referred to *A. tubæformis* Goldf.; it corresponds more nearly in size to *A. serpens* var. *minor* Goldf., in *Petref. Germ.*, p. 82, pl. 29, fig. 16, but is larger than that figure; the extremities of the tubes are more unequal, and the mode of growth and bifurcations differ.

*Formation and localities.* In the shaly limestone of the Lower Helderberg group, at Schoharie and near Clarksville, N. Y.

AULOPORA TUBULA, *n. sp.*

(PLATE II, FIGS. 7, 8.)

Corallum consisting of comparatively short, tubular cylindrical cells, gradually increasing in size to the aperture; generally two buds from each cell, sometimes three, two laterally and one from the basal portion nearer to the aperture; showing spinules in the interior; transversely corrugated and strongly striated longitudinally; growing in close aggregation from the rapid and repeated budding. Length of cell-tubes about two mm.; diameter at the apertures a little more than one mm.; diameter at the base nearly one mm.

This species differs from *A. Schohariæ* in its shorter tubes and proportionally greater diameter, its more frequent gemmation and closer aggregation of growth.

*Formation and locality.* In the shaly limestones of the Lower Helderberg group, Schoharie, N. Y.

AULOPORA SUBTENUIS, *n. sp.*

(PLATE II, FIGS. 9-18)

Corallum consisting of elongate, slender, tubular cells, very gradually enlarging to the aperture, generally only a single budding, but sometimes two, and very rarely three. Cell-tubes straight to the point of budding, when they abruptly turn to one side. Length about eight mm.; diameter at aperture one mm., at smaller end, .75 mm. Sometimes quite strongly corrugated and longitudinally striated; surface in some specimens apparently papillose.

This species may be distinguished from *A. Schohariae* by its more slender form, greater length, and by its mode of budding. In *A. Schohariae*, where two buds proceed from one tube, they are at about the same distance from the aperture, and one on each side of a central line, and the cell ceases to grow after budding, while in this species the buds are in the centre of the posterior part of the tube in a direct line, and sometimes two mm. apart. In all the specimens, so far seen, the apertures do not turn upward after budding, but to one side.

*Formation and locality.* Lower Helderberg group, near Clarksville, N. Y.

AULOPORA ELONGATA, *n. sp.*

(PLATE II, FIGS. 19, 20.)

Corallum consisting of comparatively large, cylindrical, tubular cells, increasing by one or two buds from each cell; when two, they are bilateral. Length of tubes about eight mm.; diameter at apertures two mm.; corrugated and striated longitudinally.

*Formation and locality.* Lower Helderberg group, Schoharie, N. Y.

AULOPORA? CORNULITES, *n. sp.*

(PLATE II, FIGS. 21, 22)

Length of tube six mm.; diameter at the apertures a little less than two mm.; surface marked by numerous, comparatively strong transverse annulations, and by longitudinal striæ.

*Formation and locality.* Lower Helderberg group, near Clarksville, N. Y.

VERMIPORA, *Hall.*

## VERMIPORA SERPULOIDES.

(PLATE II, FIGS. 24-31.)

*Vermipora serpuloides.* HALL. Twenty-sixth Rep. N. Y. State Mus. Nat. Hist., p. 110. 1874.

Corallum ramose, solid, consisting of contiguous, cylindrical tubes, increasing by interstitial additions. Branches from two to eight mm. in diameter. Tubes

nearly parallel, sinuous, and marked by transverse lines of growth. Length reaching fourteen mm.; diameter at aperture from one-half to nearly one mm.

Dr. Rominger, in his description, speaks of diaphragms and lateral pores, in a form described by him, but with a careful examination of numerous specimens and transparent sections, I have been unable to find either of these characters in the typical species.

*Formation and locality.* Lower Helderberg group, Schoharie, N. Y.

#### VERMIPORA ROBUSTA, *n. sp.*

(PLATE II, FIGS. 32, 33.)

Corallum ramose, tubes from six to eight mm. in length, and two mm. in diameter at the aperture; diameter of branch seven mm.; surface marked by obscure transverse striæ and undulations.

This species differs from *V. serpuloides* in its much larger size and comparatively shorter cell-tubes.

*Formation and locality.* Lower Helderberg group, Schoharie, N. Y.

#### VERMIPORA? TORTUOSA, *n. sp.*

(PLATE II, FIG. 23.)

Corallum consisting of elongate cylindrical tubes, increasing by interstitial additions. Length of single tube four mm.; diameter at mouth .50 mm.; surface marked by numerous oblique transverse annulations which give to the tube a twisted appearance.

*Formation and locality.* Lower Helderberg group, near Clarksville, N. Y.

#### STRIATOPORA, *Hall.*

##### STRIATOPORA ISSA.

(PLATE III, FIGS. 14, 15.)

*Striatopora Issa*, HALL. Twenty-sixth Rep. N. Y. State Mus. Nat. Hist., p. 114. 1874.

Corallum ramose, solid; bifurcations distant; diameter of the branches about ten mm.; cells polygonal, arising from the centre of the branch, rapidly increasing in size, and quite abruptly curving to the surface; diameter of the larger cells at the aperture about two mm.; cell-walls thick, strongly striated; mural pores large, round.

This is the most robust species of this genus yet noticed, and the cells are large in proportion; it is not a common form and is generally found in detached pieces on the weathered surfaces of blocks of limestone.

*Formation and locality.* In limestones of the Lower Helderberg group, Clarksville, N. Y.

MICHELINA, *De Koninck*.

## MICHELINA LENTICULARIS.

(PLATE III, FIGS. 1, 2, 3, 5.)

*Michelina lenticularis*, HALL. Twenty-sixth Rep. N. Y. State Mus. Nat. Hist., p. 113. 1874.

Corallum forming small lenticular bodies, the lower surface the less convex, and covered with a strongly wrinkled epitheca; cells large and few, broadly campanulate; partition walls thin, strongly striate longitudinally, with the margins denticulate—the number of striae and denticulations varying with the size of the cell.

In a specimen of twenty mm. in diameter, there are about twelve cells, the larger ones somewhat more than six mm. in diameter. The entire height of the specimen is about the same as the width.

This is a very small species, seldom attaining a diameter of more than twenty-five mm. This form with the large cells and their strongly granulose-striate character, are distinctive features.

*Formation and localities.* In the shaly limestones of the Lower Helderberg group, near Clarksville and Schoharie, N. Y.

FAVOSITES, *Lamarck*.

## FAVOSITES HELDERBERGÆ.

PLATES IV, V, VI.

*Favosites Helderbergiæ*, HALL. Twenty-sixth Rep. N. Y. State Mus. Nat. Hist., p. 111. 1874.

Corallum growing in large, lenticular, depressed-convex or hemispherical masses, base covered by a strongly wrinkled epitheca. Cell-tubes polygonal, averaging about one and one-half mm. in diameter, their inner surface showing evidence of a few strong longitudinal striae, and more frequently above the mural pores; mural pores in one or two ranges, comparatively large, circular, with margins distinctly elevated; cell-walls thin, but greatly increasing by silicification; transverse partitions strong, numerous, about three in a space equal to the diameter of the cell-tube.

In many specimens some of the cell-tubes are larger and less angular than those surrounding them, being a little more than two mm. in diameter, with thicker walls. A single specimen from Coeymans Landing has slightly larger tubes on one portion, while in all the others the cells have the ordinary characters.

This species differs from the *Favosites Niagarensis*, which it resembles in the size of the cells, in having more numerous diaphragms, and in the mural pores being on the lateral faces instead of at the angles of the cells.

*Formation and localities.* In the shaly limestones of the Lower Helderberg group, near Clarksville, Albany county. It is here found weathered out from the rock and silicified, frequently in masses of a foot or more in diameter. It is also found in several localities in Schoharie county. Smaller specimens of what appears to be the same or a closely allied form occur at Cole's quarry, Herkimer county, N. Y. The species likewise occurs near Cumberland, Md., having the cells somewhat smaller than those of New York specimens.

### FAVOSITES CONICA, Hall.

(PLATE III, FIGS. 4, 6, 13)

*Favosites conica*, HALL. Twenty-sixth Rep. N. Y. State Mus. Nat. Hist., p. 112. 1874.

Corallum forming conical masses; flattened at the base, which is covered with a strongly wrinkled epitheca. Cells arising from the centre of the base, quite abruptly curving to the surface, increasing by interstitial additions; polygonal; from four to eight-sided, variable in size, the larger ones being three mm. in diameter; dividing walls thin; mural-pores comparatively large, circular, with distinctly raised margins, in one, two and sometimes three ranges; where two ranges occur, the pores alternate with each other; where more than two ranges occur, the arrangement of the pores is more irregular; transverse partitions closely arranged, two or three in a distance equal to the diameter of a tube.

The conical form of this species, and the inequality of the cells, distinguish it from every other known Favosites of the New York formations. The specimens are usually from one inch to three inches in diameter.

*Formation and locality.* In the shaly limestones of the Lower Helderberg group, near Clarksville, N. Y.

### FAVOSITES INEXPECTANS.

(PLATE IX, FIGS. 16, 17.)

*Chaetetes Helderbergiae*, HALL. Twenty-sixth Rep. N. Y. St. Mus. Nat. Hist., p. 110. 1874.

Not *Favosites Helderbergia*, HALL. Twenty-sixth Rep. N. Y. State Mus. Nat. Hist., p. 111. 1874.

Corallum ramose; diameter of branches, ten mm.; cell-tubes polygonal, very long and slender, rising from the centre of the branch and gradually curving to the surface; diameter of the cell-apertures from .50-.65 mm.; transverse partitions very thin; mural-pores large, one or two series on each face of the tube walls, which have numerous oblique corrugations.

*Formation and localities.* In the shaly limestone of the Lower Helderberg group, at Catskill creek, near Clarksville, and at Schoharie, N. Y.

### FAVOSITES SPHERICUS.

*Chaetetes spherica*, HALL. Twenty-sixth Rep. N. Y. State Museum Nat. Hist., p. 113. 1874.

Corallum forming globose or depressed-globose bodies, composed of minute, radiating cells, about .35 mm. in diameter, having comparatively thick walls,

which are perforated at regular distances by large pores, distant from each other less than the diameter of the tube, generally a single series on each face of the wall; transverse plates rather closely arranged.

From the globular form of this small species, and where the external characters are obscured by shale, it may be mistaken for the species of *ASTYLOSPONGIA*, found in the same rocks. The largest specimens observed are about four centimetres in diameter.

*Formation and localities.* In the shaly limestone of the Lower Helderberg group, near Clarksville, and Catskill creek, N. Y.

#### FAVOSITES MINIMUS.

(PLATE VII, FIGS. 1-12.)

*Favosites? minima*, HALL. Twenty-sixth Rep. State Mus. Nat. Hist., p. 113. 1874.

Corallum massive, variable in form. Cell-tubes small, polygonal, generally hexagonal, from two to thirteen mm. or more in length; diameter .25-.35 mm.; there are numerous maculae where the cells are larger than the others, being about .50 mm. in diameter. Cell-walls thin, more or less corrugated and striated transversely; septa strong, distant from each other a space equal to two or three times the diameter of the tube; mural pores minute, comparatively distant, a single series on each face of the tube.

This species is very variable in its mode of growth, sometimes occurring in branching forms, with the cell-tubes commencing at the centre, and gradually curving upward and outward to the surface; others are in hemispherical masses, with a flat base, the tubes radiating from the centre of the base to the surface; increasing by interstitial or lateral additions; sometimes in masses formed of successive layers as if by interruptions in growth; it is also found incrusting crinoid stems and other objects, especially the basal portion of *LEPADOCRINUS*, occurring in layers of sometimes not more than two mm. in thickness.

It differs from *F. proximus* in its smaller cell-tubes, the thinner walls, and the frequent maculae of larger cells.

*Formation and localities.* Lower Helderberg group, Schoharie, and near Clarksville, N. Y.

#### FAVOSITES PROXIMUS, *n. sp.*

(PLATE VII, FIGS. 13-15.)

Corallum forming irregular masses; cell-tubes polygonal, of nearly uniform size; diameter slightly more than .50 mm.; transverse partitions strong, generally distant from each other a space equal to twice the diameter of the cell-tubes, though frequently occurring much closer; mural-pores minute, occurring in one or two series on each face of the tube.

This species in general appearance is very similar to *F. minimus*, but may be distinguished from that species by its larger cells, thicker and smoother cell-walls and the absence of maculae of larger cells.

*Formation and locality.* Lower Helderberg group, Schoharie, N. Y.

CHÆTETES, *Fischer.*CHÆTETES MONTICULATUS, *n. sp.*

(PLATE VIII, FIGS. 5-7.)

Corallum forming spheroidal masses. Cell-tubes small, polygonal, .35 mm. in diameter at aperture; cell-walls thin, strongly corrugated; transverse partitions slightly thinner than the cell-walls, occurring at irregular intervals, varying from .35 mm. to eight mm. or even more; surface having frequent strongly elevated nodes, with cells of the same size as on other parts of the surface, arranged in intersecting rows.

This species in general appearance is similar to *C. colliculatus*, but may be distinguished from that species by its smaller cell-tubes, more numerous nodes, spheroidal form and difference in septa.

*Formation and locality.* Lower Helderberg group, Schoharie, N. Y.

CHÆTETES COLLICULATUS, *n. sp.*

(PLATE VIII, FIGS. 1-4.)

Corallum hemispheric, base flat or concave, covered by a wrinkled epitheca. Cell-tubes polygonal, nearly .5 mm. in diameter at the aperture; surface having frequent strongly elevated nodes, with cells about the same size as the others; septa thin and infrequent.

This species differs from *C. monticulatus* in form and in the size of cells.

*Formation and locality.* Lower Helderberg group, Schoharie, N. Y.

CHÆTETES FRUTICOSUS, *n. sp.*

(PLATE IX, FIGS. 1-8.)

Corallum ramose, solid; branches slender, frequent; diameter generally from two to two and one-half mm.; cell-tubes polygonal, arising from the centre of the branch, and very gradually diverging to the surface; opening very slightly oblique to the surface; five mm. or more in length; diameter less than .25 mm.; cell-tubes thin, apparently slightly corrugated transversely; septa thin, and very infrequent.

This species can be distinguished from *C. abruptus*, plate ix, figs. 9-11, by its more slender branches, which character seems to be constant, but especially by the manner in which the tubes approach the surface, the thinner and more infrequent septa.

*Formation and locality.* Lower Helderberg group, Schoharie, N. Y.

CHÆTETES ABRUPTUS, *n. sp.*

(PLATE IX, FIGS. 9-11.)

Corallum ramose, solid; branches frequent; cell-tubes polygonal, small, arising from the centre of the branch, and gradually diverging till within about two mm.



from the surface, when they abruptly turn outward, and at this point are generally constricted, and the cell-walls, previously very thin, become much thicker; transverse partitions rare or entirely wanting until after the abrupt turn of the tubes, when they are numerous; length of longest cell-tubes six mm.; diameter at aperture .25 mm.; cells of nearly uniform size, frequently spinulose at the angles.

This species may be easily recognized, when a longitudinal section can be seen, by the abrupt turn of the cell-tubes to the surface, in which respect it differs from any other known species of this formation.

*Formation and locality.* Lower Helderberg group, Schoharie, N. Y.

#### CHÆTETES TABULATUS.

(PLATE IX, FIGS. 12-15.)

*Chatetes tabulatus*, HALL. Illustrations of Devonian Fossils: Corals, plate 37, figs. 16, 19. 1876.

Corallum forming spheroidal or hemispheric masses; diameter of the largest specimen seen a little more than four mm.; tubes arising from the centre of the base, and increasing by interstitial additions; diameter at the aperture about .50 mm.; cell-walls thin, transverse; diaphragms, so far as observed, wanting; the cell-walls are strongly and quite regularly corrugated; the corrugations are nodose at the angles of the cell-walls; about fifteen in the space of five mm.

*Formation and locality.* Lower Helderberg group, Schoharie, N. Y.

#### CHÆTETES CORTICOSA.

(PLATE X, FIGS. 1-10, AND PLATE XIII, FIG. 4.)

*Trematopora corticosa*, HALL. Twenty-sixth Report N. Y. State Mus. Nat. Hist., p. 105. 1874.

Bryozoum ramose, solid; branches frequent, diverging at an angle of about ninety degrees; diameter of larger branches five mm.; cells contiguous, generally pentagonal, hexagonal or apparently oval from thickening of the margins, arising from the centre of the branch and gradually curving to the surface, increasing by interstitial additions; septa strong, distant from each other by a space equal to two or three times the diameter of a cell-tube; cell-walls thickened toward the apertures, frequently forming irregular ridges like the miniature roughened bark of a tree.

This species is easily recognized by its peculiarly roughened surface, and widely diverging branches.

*Formation and locality.* In the shaly limestones of the Lower Helderberg group, near Clarksville, N. Y.

TREMATOPORA, *Hall*.

## TREMATOPORA } (CHÆTETES) DENSA.

(PLATE X, FIGS. 11-13.)

*Trematopora densa*, HALL. Twenty-sixth Report N. Y. State Mus. Nat. Hist., p. 105. 1874.

Bryozoum ramose, solid; diameter of larger branches three mm.; cell-tubes polygonal, arising from the centre of the branch, and gradually curving to the surface; diameter of apertures variable, but averaging about .35 mm. surface, with occasional maculæ where the cells are larger, being about .50 mm. On well-preserved specimens the angles are frequently spinose; septa few and only occurring near the surface.

*Formation and localities.* In the shaly limestone of the Lower Helderberg group, at Catskill creek and near Clarksville, N. Y.

## TREMATOPORA [?] CONSTRICTA.

(PLATE X, FIGS. 14-19.)

*Trematopora constricta*, HALL. Twenty-sixth Report N. Y. State Mus. Nat. Hist., p. 104. 1874.

Bryozoum ramose, hollow, frequently branching; branches from two to four mm. in diameter; thickness of bryozoum about .35 mm.; cell-tubes oval; apertures closely arranged in more or less regular, quincunx order, opening obliquely upward; margin of upper part of aperture not elevated, of posterior part strongly elevated, extending over the lower portion and forming a projecting lip. There are frequent maculæ where the cells are larger than in other places, one of them being equal in size to two ordinary cells, and frequently radiating; inner surface of the branch (epitheca) strongly wrinkled transversely, and longitudinally striated by the recumbent position of the cell-tubes.

*Formation and locality.* Lower Helderberg group, near Clarksville, N. Y.

TREMATOPORA DISPERSA, *n. sp.*

(PLATE X, FIGS. 20, 21.)

Bryozoum ramose; branches hollow; diameter about three mm.; cell-apertures circular, or slightly oval; about .30 mm. in diameter; very irregularly arranged; in some parts contiguous, and in other parts there are large spaces destitute of cells; margins of apertures very distinctly elevated.

This species differs from *T. constricta* in the cells being much less oblique, and much more irregularly arranged.

*Formation and locality.* Lower Helderberg group, near Clarksville, N. Y.

## TREMATOPORA REGULARIS.

(PLATE XI, FIGS. 1-8, AND PLATE XIII, FIGS. 1-3.)

*Trematopora regularis*, HALL. Twenty-sixth Rep. N. Y. State Mus. Nat. Hist., p. 106. 1874.

Bryozoum ramose, solid, slender; branches frequent, widely diverging; diameter of larger branches about one mm.; cell-apertures elongate oval, arranged in longitudinal, parallel lines, alternating, forming a quincunx arrangement; about eighteen in the space of five mm. longitudinally; generally five rows in the width of a branch, sometimes a short spine at the lower end of the cell-aperture; space between the rows of apertures frequently elevated into a ridge, which in well-preserved specimens has a serrated crest.

This species is easily distinguished by its slender branches and the arrangement of cell-apertures in parallel longitudinal rows, separated by an elevated ridge.

*Formation and locality.* In the shaly limestones of the Lower Helderberg group, near Clarksville, N. Y.

TREMATOPORA OVATIPORA, *n. sp.*

(PLATE XI, FIGS. 9, 10.)

Bryozoum ramose, solid, slender; diameter of the branch about one mm.; cell-apertures ovate, about twice as long as wide, arranged in parallel, longitudinal rows; eight cells in the space of five mm. longitudinally; three rows in the width of a branch; a short spine at the base of each cell; margins slightly elevated, granulose.

This species can be distinguished from *T. regularis* by its much larger ovate cells and coarser appearance generally.

*Formation and locality.* Lower Helderberg group, near Clarksville, N. Y.

TREMATOPORA CANALICULATA, *n. sp.*

(PLATE XI, FIG. 12.)

Bryozoum ramose, solid; diameter one mm.; cell-apertures comparatively large, oval, distant: length about .20, and width .10 mm.; arranged in quincunx order; space between cell-apertures channeled, leaving their margins elevated. Always on the margin at the ends of the aperture, and frequently on other parts of the margin, there is a short, obtuse spine.

This species, in its arrangement of cell-apertures, is very similar to *T. rhombifera*, but differs from that species by having the cell-apertures much more distinctly oval, and more widely separated, the space between the cell-apertures being channeled.

*Formation and locality.* Lower Helderberg group, near Clarksville, N. Y.

TREMATOPORA PARALLELA, *n. sp.*

(PLATE XI, FIGS. 13, 14.)

Bryozoum ramose, solid; diameter of branches about one mm.; cell-apertures oval, .30 mm. in length, closely arranged in parallel, longitudinal and oblique transverse rows; margins elevated, ornamented with four or five minute spinules.

This species differs from *T. regularis* in its larger cell-apertures, which are more closely arranged, and is without the longitudinal ridge dividing the rows of apertures.

*Formation and locality.* Lower Helderberg Group, near Clarksville, N. Y.

## TREMATOPORA RHOMBIFERA.

(PLATE XI, FIGS. 15-20.)

*Trematopora rhombifera*, HALL. Twenty-sixth Rep. N. Y. State Mus. Nat. Hist., p. 103. 1874.

Bryozoum ramose, solid; diameter of branches from one-half of one mm. to two mm.; cell-tubes arising from the centre of the branch and quite abruptly curving to the surface; cell-apertures oval or rhomboidal, numerous, contiguous; eighteen in the space of five mm. longitudinally, and twenty-four in the same space transversely; arranged spirally around the branch in quincunx order; cell-walls thin, but frequently thickened by silicification; in well-preserved specimens serrated on their edges.

*Formation and localities.* Lower Helderberg group, near Clarksville, and at Schoharie, N. Y.

TREMATOPORA CRASSA, *n. sp.*

(PLATE XI, FIGS. 21, 22.)

Bryozoum forming irregular expansions or hollow branches; cells .25 mm. in diameter, circular, irregularly and closely arranged; margins of apertures thin, but slightly elevated; surface marked by frequent maculæ, which are destitute of cells.

*Formation and locality.* Lower Helderberg group, Schoharie, N. Y.

CALLOPORA, *Hall.*

## CALLOPORA MACROPORA.

(PLATE XI, FIGS. 23-29.)

*Callopora macropora*, HALL. Twenty-sixth Rep. N. Y. State Mus. Nat. Hist., p. 100. 1874.

Bryozoum ramose, solid, slender, from one to two mm. in diameter; branches comparatively infrequent, widely diverging; cell-apertures elongate, oval, or polygonal, variable in size, margins elevated, intercellular spaces narrow; frequently the cells are contiguous, intercellular pits small, angular; generally only a single range; cell-margins frequently spinulose at the angle.

This is a very distinct and well-marked species, characterized by its large cells and slender branches. A single branch, apparently belonging to the species, has been found in the Niagara shale at Lockport.

*Formation and localities.* In the shaly limestone of the Lower Helderberg group, at Catskill, Greene county; near Clarksville, and at Schoharie, N. Y.

CALLOPORA MACROPORA, *var. SIGNATA*, *n. var.*

(PLATE XI, FIGS. 30, 31.)

*Trematopora signata*, HALL. Twenty-sixth Rep. of the N. Y. State Mus. Nat. Hist., p. 104. 1874.

This variety differs from the usual form of *C. macropora* in the more distinctly polygonal cell-apertures, and in having but very few intercellular pits.

*Formation and locality.* Lower Helderberg group, near Clarksville, N. Y.

CALLOPORA HETEROPORA.

(PLATE XI, FIGS. 32, 34, AND PLATE XIII, FIGS. 5-8.)

*Callopora heteropora*, HALL. Twenty-sixth Rep. of the N. Y. State Mus. Nat. Hist., p. 102. 1874.

Bryozoum ramose, solid; branches one mm. in diameter; cell-apertures oval, about .25 mm. in length, irregularly arranged, distance from each other varying from contiguity to the length of an aperture; cell-margins elevated, and in well-preserved specimens spinulose; intercellular spaces occupied by minute, angular pits, of about .15 mm. in length.

*Formation and locality.* Lower Helderberg group, near Clarksville, N. Y.

CALLOPORA UNISPINA.

(PLATE XI, FIGS. 35-39 and ? 40, 41.)

*Callopora unispina*, HALL. Twenty-sixth Rep. N. Y. St. Mus. Nat. Hist., p. 101. 1874.

Bryozoum ramose, solid; diameter of the larger specimens two mm.; branches infrequent, widely diverging; cell-apertures oval; length about .25 mm.; width a little more than half the length; distance from each other varying from contiguity to a little more than twice their width; cell margins elevated, and generally having, at the base of each aperture a comparatively large, obtuse spine, though this feature is by no means invariable—in some specimens but few of the cells having spines; intercellular spaces occupied by small polygonal pits, in from one to three ranges, with sharply elevated margins.

*Formation and localities.* In the shaly limestone of the Lower Helderberg group, at Catskill creek, and near Clarksville, N. Y.

*CALLOPORA CELLULOSA, n. sp.*

(PLATE XII, FIGS. 7-9, AND PLATE XIII, FIG. 9.)

Bryozoum ramose, solid, branching infrequently; diameter of larger branches about four mm.; cell-tubes arising from the centre of the branch, gradually diverging, curving outward to near the surface, when they turn quite abruptly to the surface; diameter at aperture about .15 mm.; apertures irregularly arranged, the distance from each other varying from contiguity to two or more times their diameter; margins elevated; intercellular spaces occupied by small polygonal pits, generally in two, occasionally three ranges; margins elevated; in well-preserved specimens the margins of both the cells and intercellular pits have small, short spines.

*Formation and locality.* In the shaly limestone of the Lower Helderberg group, near Clarksville, N. Y.

*CALLOPORA FISTULOSA, n. sp.*

(PLATE XII, FIGS. 1-6.)

The surface of this species very much resembles *Callopora cellulosa*, but differs in having frequent large openings which continue to the centre of the branch; the space surrounding the opening being much elevated and strongly striated. It may be a different mode of growth of the preceding species.

*Formation and locality.* Lower Helderberg group, near Clarksville, N. Y.

*CALLOPORA PERELEGANS.*

(PLATE XII, FIGS. 10-17.)

*Callopora perelegans*, HALL. Twenty-sixth Rep. N. Y. State Mus. Nat. Hist., p. 102. 1874.

Bryozoum ramose, solid; branches very frequent, not widely diverging; diameter from three to seven mm.; cell-tubes commencing in the centre of the branch, gradually enlarging and curving to the surface; length of tubes three mm.; diameter at aperture nearly .50 mm.; circular, or sometimes slightly subangular at their junction with the intercellular pits; distance from each other varying from contiguity to more than their diameter; cell-margins elevated, and occasionally, in well-preserved specimens, spinulose; intercellular spaces occupied by comparatively large, polygonal pits, in from one to three ranges, variable in size and shape; frequently, where only one range occurs, the length is more than twice the width; the transverse septa across the intercellular spaces are very regular and distinct.

This species is very similar to *Callopora elegantula* of the Niagara group, differing from it only in its more marked intercellular pits.

*Formation and locality.* In the shaly limestones of the Lower Helderberg group, near Clarksville, N. Y.

## CALLOPORA HYALÆ.

(PLATE XII, FIGS. 18, 19.)

*Callopora Hyalæ*, HALL. Twenty-sixth Rep. N. Y. State Mus. Nat. Hist., p. 100. 1874.

Bryozoum ramose, branches hollow; surface marked by comparatively large, circular, or slightly oval cell-apertures which are irregularly arranged, with frequent maculæ destitute of cells. Intercellular spaces with small shallow angular pits, sometimes three or four between the apertures.

*Formation and locality.* Lower Helderberg group, near Clarksville, N. Y.

## CALLOPORA VENUSTA.

(PLATE XII, FIGS. 20-24.)

*Callopora venusta*, HALL. Twenty-sixth Rep. N. Y. State Mus. Nat. Hist., p. 101. 1874.

Bryozoum ramose, hollow; branches infrequent, widely diverging, from three to seven mm. in diameter; thickness of bryozoum about .50 mm.; cell-apertures oval, about .20 mm. in length, width one-half the length; distance from each other generally equal to the width; arranged in a more or less regular quincunx order; cell-margins elevated; intercellular space channeled, having generally a single series of angular pits, the margins of which are but slightly elevated; frequently they are so indistinct that the intercellular space presents only a smooth, channeled appearance. There are occasional maculæ destitute of cells; inner surface of the branches marked by strong, concentric wrinkles, and by fine, longitudinal lines made by the recumbent portions of the cell-tubes.

This species presents somewhat the appearance of *C. cellulosa*, but is easily distinguished from that species by its oval cells, their closer and more regular arrangement, the single series of intercellular pits and the hollow branches — that species being solid.

*Formation and locality.* Lower Helderberg group, near Clarksville, N. Y.

CALLOPORA OCULIFERA, *n. sp.*

(PLATE XIII, FIG. 10.)

Bryozoum ramose, solid; diameter of branches one mm.; cell-apertures broadly oval; length about .30 mm., quite regularly arranged in longitudinal rows, distant from each other less than the length of an aperture; margins thin; the slightly elevated space between the apertures occupied by minute angular pits, in one or two series, between adjacent apertures.

*Formation and locality.* Lower Helderberg group, near Clarksville, N. Y.

## CALLOPORA MACULOSA.

(PLATE XIV, FIGS. 1-8.)

*Trematopora ponderosa*, HALL. Twenty-sixth Rep. N. Y. State Mus. Nat. Hist., p. 106. 1874.

*Trematopora maculosa*, HALL. Twenty-sixth Rep. N. Y. State Mus. Nat. Hist., p. 106. 1874.

Bryozoum lamelliform, free or incrusting, generally occurring in masses composed of numerous successive layers of growth; thickness of separate layers from less than one mm. to three mm. or more; celluliferous on one side; lower surface covered by an epitheca, with strong concentric wrinkles and radiating striæ; cell-tubes round or oval, generally opening at right angles to the surface; diameter of apertures about .25 mm.; distance from each other a little less than the diameter of the aperture, with frequent maculæ destitute of cell-apertures, the cells around these being larger than the ordinary cells, frequently radiating, and opening obliquely; cell-margins elevated; on the thinner fronds and near the margins of others, the cells open quite obliquely, the posterior margin frequently extending over and constricting the aperture, forming an elevated, projecting lip, and sometimes presenting very much the appearance of a CERAMOPORA. Intercellular spaces channeled, smooth or rugulose from the intercellular pits; sometimes the pits themselves are visible. In a vertical section the intercellular spaces are shown to be strongly vesiculose, the transverse septa being arched.

A critical study of numerous specimens has shown that the species originally described as *Trematopora ponderosa* and *T. maculosa* are not distinct, and the internal structure of both are like typical forms of CALLOPORA.

*Formation and localities.* In the shaly limestones of the Lower Helderberg group, at Catskill creek, and near Clarksville, N. Y.

## CALLOPORA PONDEROSA.

(PLATE XIV, FIGS. 9-12.)

*Callopora ponderosa*, HALL. Twenty-sixth Rep. N. Y. State Mus. Nat. Hist., p. 103. 1874.

Bryozoum explanate, either free or incrusting, generally growing in large masses composed of numerous successive layers; thickness of separate layers two mm. or more; lower surface covered by an epitheca, marked by strong, concentric wrinkles and radiating striæ; cell-apertures round, .25 mm. in diameter, distance from each other variable, frequently less than their diameter; cell-margins thin, elevated, having one or more comparatively large spines, causing the surface of well-preserved specimens to present an echinate appearance; intercellular spaces occupied by minute polygonal pits, in from one to three ranges.

*Formation and locality.* In the shaly limestones of the Lower Helderberg group, at Schoharie, N. Y.



CALLOPORA PARASITICA, *n. sp.*

(PLATE XIV, FIGS. 13-18.)

Bryozoum foliate, incrusting or free; width of largest specimen seen, twenty mm.; thickness .50 mm.; cell-tubes at first oblique, but opening directly upward; apertures comparatively large, nearly oval, very slightly angular, about .20 mm. in length, .15 mm. in width; cell-margins elevated, frequently spinose at the angles; distance from each other varying from two to three times their width; intercellular spaces occupied by polygonal pits, with distinctly elevated margins, in from one to three series; lower surface covered with an epitheca marked by strong, concentric rugæ, and by radiating striæ formed by the recumbent portions of the cell-tubes.

*Formation and locality.* In the shaly limestone of the Lower Helderberg group, near Clarksville, N. Y.

LICHENALIA, *Hall.*LICHENALIA TORTA, *n. sp.*

(PLATE XV, FIGS. 1-7, AND PLATE XIII, FIGS. 17, 18.)

Bryozoum a thin lamellose expansion, celluliferous on one side; lower surface covered with an epitheca marked by concentric wrinkles and by fine concentric striæ; cell-tubes comparatively large, radiating from the centre to the margin; cylindrical, gradually enlarging to the aperture; recumbent, and nearly parallel with the surface for the greater part of their length; near the apertures bending quite abruptly upward, and opening slightly oblique to the surface; length of cell-tubes from one to four mm.; diameter at aperture nearly .5 mm., arranged in intersecting rows; intercellular space channeled; sometimes a slight ridge runs from the anterior portion of one cell to the posterior portion of another. Where the cell-tubes are worn away, the surface is covered by fine, sharp, regular striæ, which become slightly nodose in crossing the concentric lines. There are frequent nodes on the surface of well-preserved specimens.

A specimen showing the cells well preserved is very rarely found, the usual condition being with the cells entirely removed, and showing the concentric and radiating striæ.

This species can be distinguished from *L. distans*, plate xv, figs. 8, 9, by its larger, circular cell-apertures, and their more regular arrangement.

*Formation and localities.* Lower Helderberg group, near Clarksville, and Schoharie, N. Y.

LICHENALIA DISTANS, *n. sp.*

(PLATE XV, FIGS. 8, 9.)

Bryozoum foliate, incrusting or free; about .65 mm. in thickness; celluliferous on one side; lower surface covered by a wrinkled epitheca; cell-apertures

small, oval, or suboval; margins elevated; length about .30 mm., irregularly arranged.

This species is very similar, in general appearance, to *L. torta* (plate xv, figs. 1-7), but may be distinguished from that one by its smaller and irregularly arranged oval pores.

*Formation and locality.* Lower Helderberg group, Schoharie, N. Y.

#### LICHENALIA DISSIMILIS, *n. sp.*

(PLATE XV, FIGS. 10-13.)

Bryozoum consisting of large, irregularly undulating, foliate expansions, of one mm. or more in thickness; width of largest specimen observed 120 mm.; celluliferous on one side; lower surface covered by a wrinkled epitheca; cells arising from the epitheca, and opening very obliquely to the surface, frequently alternating, arched and imbricating; slightly longer than wide; length about .65 mm.

This species, in its cell-apertures, is very similar to *ALVEOLITES*, and may possibly belong to that genus.

*Formation and locality.* Lower Helderberg group, Schoharie, N. Y.

#### CERAMOPORA, *Hall.*

##### CERAMOPORA LABECULOIDEA, *n. sp.*

(PLATE XVI, FIGS. 1, 2.)

Bryozoum small, circular, very thin; cells commencing in the centre and radiating nearly to the margin, comparatively large, cylindrical or nearly so, very oblique to the surface, .25 mm. in diameter at the aperture; apertures arched, arranged in alternating and imbricating series. The bryozoum for a short distance from the margin is free from cells and undulating; lower surface covered by an epitheca, and concentrically wrinkled.

This species differs from *C. maculata* (plate xvi, figs. 5-11), in being much thinner, the cells proportionately larger, more oblique and radiating from the centre to the margin without maculae of larger cells. It bears a very close resemblance to *C. labecula* of the Niagara group, and may belong to that species.

*Formation and locality.* Lower Helderberg group, near Clarksville, N. Y.

##### CERAMOPORA PARVICELLA, *n. sp.*

(PLATE XVI, FIGS. 3, 4.)

Bryozoum thin, foliate, incrusting, celluliferous on one side. Cells consisting of very oblique, subcylindrical tubes, opening rectangularly to the plane of the surface, having frequent maculae where the cells are larger than in other portions; diameter of ordinary cell-tubes at aperture .25 mm., of the larger ones .3 mm.; apertures arched or triangular, arranged in alternating and imbricating series.

eating series ; lower surface covered by an epitheca which is strongly wrinkled concentrically, and having fine, radiating lines formed by the recumbent portion of the cell-tubes.

This species differs from *C. maculata*, plate xvi, figs. 5-11, in being incrusting, the frond much thinner, the cells smaller, more oblique and not radiating from a centre.

*Formation and locality.* Lower Helderberg group, near Clarksville, N. Y.

#### CERAMOPORA MACULATA.

(PLATE XVI, FIGS. 5-11.)

*Ceramopora maculata*, HALL. Twenty-sixth Rep. N. Y. State Mus. Nat. Hist., p. 108. 1874.

Bryozoum discoidal, flattened or concave on the lower side, covered by an epitheca having strong concentric wrinkles. Cells polygonal, radiating from the centre ; diameter at aperture one-half of one millimetre ; there are frequent maculæ where the cells are larger—about once and one-half as large as those on other portions ; cell-walls sometimes slightly elevated at the angles, forming low spine-like projections at the centre of the disc ; the cell-tubes in the central portions are at right angles to the surface, becoming more oblique as they approach the margin, where they are nearly rectangular to the central ones ; the diameters of the discs vary from six to forty mm. ; thickness of the larger specimens from two to three mm.

This species resembles *C. imbricata* of the Niagara limestone, but differs in the less distinctly hooded apertures ; the maculæ are more obscure and less strongly divided and radiate, and it also grows to a much larger size.

*Formation and localities.* Lower Helderberg group, Clarksville and Schoharie, N. Y.

#### CERAMOPORA (BERENICEA) MAXIMA.

(PLATE XVI, FIG. 12.)

*Ceramopora (Berenicea) maxima*, HALL. Twenty-sixth Rep. N. Y. State Mus. Nat. Hist., p. 109. 1874.

Bryozoum of a depressed-convex form, composed of cells which radiate from the centre of the disc, and open laterally, being nearly at right angles to the plane of the disc at the centre, and becoming more prone as they approach the margin ; apertures irregularly hexagonal, somewhat elongated from the projection of the lower margin ; diameter of aperture about one mm. ; cell-walls thick, obscurely striate inside ; their margins, at the angles of the cells, prolonged in a spine-like process ; lower surface unknown.

The single specimen found measures eighteen mm. in diameter ; it has the general features of those Palæozoic species usually referred to BERENICEA, but is much larger than their usual size. It resembles a MICHELINA with very

small cells; but on examination its characters are more like those of a Bryozoan, especially the projections at the angles of the cell-walls.

*Formation and locality.* In the shaly limestone of the Lower Helderberg group, at Schoharie, N. H.

### PALESCHARA, *Hall.*

#### PALESCHARA? *RADIATA*, *n. sp.*

(PLATE XVI, FIGS. 13, 14.)

Bryozoum consisting of a thin expansion incrusting other bodies. Cells polygonal, contiguous, oblique; apertures about .25 mm. in diameter; irregularly arranged, radiating from a central point.

*Formation and locality.* Lower Helderberg group, near Clarksville, N. Y.

#### PALESCHARA *INCRUSTANS*.

(PLATE XVI, FIGS. 15-22, ? 24.)

*Paleschara incrustans*. HALL. Twenty-sixth Rep. N. Y. State Mus. Nat. Hist., p. 106. 1874.

Bryozoum growing in Flustra-like expansions; incrusting. Cell-apertures polygonal, about .65 mm. in diameter; occasionally there are maculae where the cells are slightly larger; cell-walls thick, their margins sometimes elevated at the angles of the apertures into obtuse projections, which are not sufficiently long to be characterized as spines.

The mode of growth is not dissimilar from that of a recent FLUSTRA in its earlier stages, but the cells are less regularly arranged, and the whole has a stronger and firmer aspect.

*Formation and locality.* In the shaly limestones of the Lower Helderberg group, near Clarksville, N. Y.

#### PALESCHARA? *BILATERALIS*, *n. sp.*

(PLATE XVI, FIGS. 22, 23.)

Bryozoum membraniform; fronds large, very thin, celluliferous on both sides; mesial plate or epitheca wrinkled, and with fine transversely concentric lines. Cells very slightly elevated, and a little oblique; variable in size, form and arrangement, from quadrangular to polygonal, generally longer than wide, with maculae where the cells are larger than in other portions of the frond; length of the ordinary cell-apertures about .30 mm.; of the larger ones about .75 mm.; sometimes the length is equal to twice the width.

This is a distinct and very easily recognized species; the cells have sometimes a very regular arrangement, proceeding from a certain point in straight rows, slightly diverging, other similar rows coming in between; when having this regularity, the sides of the cells are parallel, and the angles nearly rectangular;

at other times the arrangement is very irregular, as also the form and size of the cells. Only two specimens have thus far been found, and both are fragments, so that the entire form is unknown; these fragments are each about twelve centimetres long and three centimetres wide.

*Formation and locality.* Lower Helderberg group, Clarksville, N. Y.

### STICTOPORA, *Hall.*

#### STICTOPORA PAPILLOSA, *n. sp.*

(PLATE XIII, FIGS. 12, 13.)

Bryozoom ramose. Branches moderately flattened, transverse section elongate-oval or lenticular in outline; width of branch two mm.; thickness at the middle one mm. Cell-apertures circular, about .20 mm. in diameter, generally arranged in longitudinal rows; distant from each other less than the diameter of an aperture; margins distinctly elevated and sloping.

*Formation and locality.* Lower Helderberg group, near Clarksville, N. Y.

### ESCHAROPORA, *Hall.*

#### ESCHAROPORA LIRATA.

(PLATE XVII, FIGS. 1-6.)

*Escharopora lirata.* HALL. Twenty-sixth Rep. N. Y. St. Mus. Nat. Hist., p. 100. 1874.

Bryozoom small, ensiform, gradually enlarging from an obtusely pointed striated base, for a short distance, the sides then becoming nearly parallel; width from one and a half to two mm.; transverse section lenticular in form; celliferous on both sides; a thin epitheca dividing the cells of the two sides. Cell-apertures large, arranged in longitudinal rows—five or six rows on each side; apertures elongate-oval; three in the space of one mm. longitudinally, and five in the same space transversely; the cells of the two outer rows larger than the others; longitudinal partitions thick, elevated, granulose; transverse partitions thin, deeply depressed, widening at the junction with the longitudinal partitions, and having a pore on the expanded portion.

This species differs from *E. tenuis* (plate xvii, figs. 7-13), in its smaller size, proportionally larger cells, and the peculiar lirate appearance given to it by the thick elevated walls separating the longitudinal rows of cell-apertures.

*Formation and locality.* In the upper shaly portions of the limestones of the Lower Helderberg group, Clarksville, N. Y.

#### ESCHAROPORA TENUIS.

(PLATE XVII, FIGS. 7-13.)

*Escharopora tenuis.* HALL. Twenty-sixth Rep. N. Y. St. Mus. Nat. Hist., p. 99. 1874.

Bryozoom consisting of thin, elongate, narrow stipes with a striated base; gradually enlarging from an obtuse point to a short distance above the com-

mencement of the celluliferous portion, when the sides become parallel; celluliferous on both sides. Cells arising obliquely from a thin, mesial lamina; apertures oval, rhomboidal, and occasionally hexagonal; on the central portion of the stipe the cells are of nearly uniform size, and arranged in longitudinal rows; there being fifteen cell-apertures in the space of five mm. longitudinally, and twenty in the same space transversely; longitudinal partitions thicker than the transverse. On the marginal portion the cells are larger, proportionally longer, more irregularly arranged and oblique to the others.

The transverse partitions widen at their junction with the longitudinal partitions, and frequently have a pore on the expanded portion. A single specimen has nodes similar to *E. nebulosa*.

*Formation and localities.* In the shaly limestones of the Lower Helderberg groups, Albany and Schoharie counties, N. Y.

#### ESCHAROPORA NEBULOSA.

(PLATE XVII, FIGS. 14-16.)

*Escharopora nebulosa*, HALL. Twenty-sixth Rep. N.Y. St. Mus. Nat. Hist., p. 99. 1874.

Bryozoum a thin foliate expansion, having a striated base; becoming abruptly wider and thinner at the commencement of the celluliferous portion; celluliferous on both sides. Cells arising obliquely from a thin, mesial lamina, arranged in parallel, longitudinal rows, rarely interrupted by intercalation of new rows, and then diverging slightly; apertures oval or quadrangular, occasionally hexagonal, a little longer than wide; twelve in the space of five mm. longitudinally, and eighteen in the same space transversely; longitudinal partition walls thin, rounded on the edges; transverse partitions thinner and depressed; the surface is marked by numerous nodes where the cells are larger than on other portions of the frond; thickness of the frond one and one-half mm.; width of the largest specimen observed more than fifty mm.

This species differs from *E. tenuis*, pl. xvii, figs. 7-13, in its greater breadth, nodulose surface, and the proportionally shorter cell-apertures.

*Formation and localities.* Lower Helderberg group, Catskill creek and Clarksville, N. Y.

#### ESCHAROPORA (? PALESCHARA) BIFOLIATA.

(PLATE XVII, FIGS. 17, 18.)

*Paleschara bifoliata*, HALL. Twenty-sixth Rep. N.Y. St. Mus. Nat. Hist., p. 107. 1874.

Bryozoum growing in broad, foliate expansions, celluliferous on both sides. Cells arising obliquely from a mesial lamina; thickness of frond slightly more than one mm.; greatest width of an imperfect frond eighty mm.; cell-apertures rhomboidal or hexagonal, appearing oval on worn surfaces; diameter of aperture .25 mm.; there are frequent nodes having slightly larger cells than the other portions; cell-walls thin; cells more or less regularly arranged in undulating intersecting lines.

This species can be distinguished from *E. nebulosa* (plate xvi, figs. 14-16), to which it bears some resemblance, by its rhomboidal or hexagonal cells, with equally thick walls; equal length and width, and the absence of the regular longitudinal arrangement of cells, which is characteristic of that species.

*Formation and locality.* Lower Helderberg group, Schoharie, N. Y.

### FENESTELLA, *Lonsdale.*

#### FENESTELLA COMPACTA, *n. sp.*

(PLATE XVIII, FIGS. 1-3.)

Bryozoum cup-shaped. Branches strong; eight and nine in the space of five mm.; on non-poriferous side flattened, obscurely striated and much enlarged below the bifurcations, which are infrequent.

Dissepiments strong, from one-half to equal thickness of the branches; seven in the space of five mm., expanding at their junction with the branches; rounded and depressed on both poriferous and non-poriferous sides.

Fenestrules oval or subquadrangular, width less than that of the branches.

Cell-pores small, round, in two or three ranges; sometimes the third range extends but a short distance below the bifurcations, occasionally extending nearly to the next bifurcation below; distance of pores from each other equal to or greater than the diameter, opening directly upward; margins elevated, and indenting the boarder of the fenestrule.

*Formation and locality.* Lower Helderberg group, Clarksville, N. Y.

#### FENESTELLA ARTA, *n. sp.*

(PLATE XVIII, FIGS. 4-9.)

Bryozoum cup-shaped, undulating. Branches strong, varying in width; from five to nine in the space of five mm.; on non-poriferous side round, frequently slightly angular, apparently smooth, enlarging very much below the bifurcations, being frequently double the width of the branches just above.

Dissepiments from one-half to two-thirds the thickness of the branches immediately above the bifurcations; six in the space of five mm., expanding at their junction with the branches, angular on non-poriferous side, rounded and slightly depressed on poriferous side.

Fenestrules small, varying in form from subquadrangular to oval; width from one-fourth to two-thirds that of the branches, appearing much smaller and frequently scarcely perceptible on poriferous side.

Cell-pores in two and three ranges; always three ranges immediately below the bifurcation, the third range sometimes extending but a short distance, at others nearly to the bifurcation below; pores small, round, or slightly oval; three in the space of a fenestrule; distance from each other equal to or greater than their diameter, opening directly upward; where there are three ranges of pores, the openings of the two outer ranges are oblique to the axis of the branch;

cell-margins elevated, and indenting the borders of the fenestrule; space between ranges of pores strongly striated on well-preserved specimens.

*Formation and locality.* Lower Helderberg group, Clarksville, N. Y.

FENESTELLA PAXILLATA, *n. sp.*

(PLATE XVIII, FIGS. 10-12.)

Bryozoum flabellate or funnel-shaped. Branches, compared with the size of frond, slender; five or six in the space of five mm.; bifurcations distant; branches on non-poriferous side flattened, striated; striæ fine, from four to seven on a branch; for a short distance below the bifurcation is a broad, shallow, groove, extending less distinctly and narrower nearly the whole length of the branch.

Dissepiments four in the space of six mm.; width about two-thirds that of the branches, rapidly expanding at their junction with the branches; on non-poriferous side they are on the same plane as the branches; on poriferous side depressed.

Fenestrules oval to subquadrangular; a little more than twice as long as wide; width slightly more than that of the branches.

Cell-pores in three ranges, except for the distance of about two fenestrules below the bifurcations, where there are four in this space; the two central ranges are very close together and alternating, and open directly upward; the ranges on the sides are distant from the central range or ranges, and open so directly outward that, in looking perpendicularly upon the specimen, they are scarcely visible; margin of cells but very little elevated; six in the space of a fenestrule.

On account of the distant bifurcations, the branches run directly parallel for some distance, without increasing in size, which gives to the frond a peculiarly rigid appearance, distinguishing it from any other species.

*Formation and locality.* Lower Helderberg group, near Clarksville, N. Y.

FENESTELLA COMPRESSA, *n. sp.*

(PLATE XVIII, FIGS. 14-18.)

Bryozoum funnel-shaped. Branches, five in the space of five mm., much enlarged near the frequent and irregular bifurcations; on the non-poriferous side branches round, with fine but distinct striæ, which are frequently finely granulose; five or six on a branch.

Dissepiments about one-half as wide as the branches, granulose-striate, slightly expanding at their junction with the branches, occurring at irregular intervals, averaging about four in the space of five mm.

Fenestrules very variable in shape, from elongate-ovate to broadly oval or subquadrangular; width about one and one-half greater than that of the branches; length from two to three times the width.



Cell-pores in from two to four ranges; immediately below the bifurcations there are occasionally four ranges, for the distance of one and one-half or two fenestrules there are three ranges, and for the remainder of the distance to the next bifurcation there are two; where three and four ranges occur, the branch is flattened on the top, and much wider than in the other portion; the central range or ranges open directly upward, the others directly outward, so that where three ranges occur, in looking directly upon the specimen, the two outer ranges are scarcely perceptible. Pores large, round, closely arranged, five in the space of a fenestrule; cell-margins thin, but very slightly elevated; space between ranges of pores and dissepiments obscurely, tortuously striated.

*Formation and locality.* Lower Helderberg group, near Clarksville, N. Y.

### FENESTELLA (POLYPORA) LILÆA.

(PLATE XVIII, FIGS. 19, 20.)

*Polypora Lilia*, HALL. Twenty-sixth Rep. N. Y. State Mus. Nat. Hist., p. 96. 1874.

Bryozoum fan-shaped. Branches moderately strong, seven or eight in the space of five mm.; on non-poriferous side rounded, striated; striæ obscure.

Dissepiments one-half the width of the branches, five or six in the space of six mm., enlarging at their junction with the branches.

Fenestrules subquadrangular to oval; width varying from equal to the branches to one-half greater; length from two to two and one-half times the width.

Cell-pores in from two to four ranges, large, oval, contiguous, alternating, and forming on the broader part of the branch, oblique intersecting rows; margins very slightly elevated; generally, on the dissepiment near the junction with the branch, there is a single cell-pore, and occasionally the entire dissepiment is poriferous.

*Formation and localities.* Lower Helderberg group, Schoharie, and near Clarksville, N. Y.

### FENESTELLA EUDORA, *n. sp.*

(PLATE XIX, FIGS. 3-10 and ? 1, 2.)

Bryozoum fan-shaped; stipe at base nearly one mm. in diameter. Branches moderately strong near base, becoming more slender above; bifurcations frequent and irregular below, becoming more distant above; on non-poriferous side, branches rounded, striated; striæ obscure, from five to seven on a branch; from eight to ten branches in the space of five mm.

Dissepiments, five in the space of five mm.; width not quite one-half that of the larger branches, expanding at their junction with the branches; on poriferous side of frond slightly depressed, striated.

Fenestrules quadrangular, variable in width, but generally about as wide as the branch; the more slender the branch, the narrower the fenestrules; length from one and one-half to three times the width.

Cell-pores in two ranges, broad-oval or round, very closely arranged, opening slightly obliquely outward, and but very slightly upward; from four to six in the space of a fenestrule; cell-margins thin, elevated, slightly indenting the border of the fenestrule; pores in the opposite ranges alternating; space between ranges of pores not carinated in some cases, in others very slightly carinated, or obtusely angular; obscurely striated, and occasionally a line of obscure nodes.

*Formation and locality.* Lower Helderberg group, near Clarksville, N. Y.

FENESTELLA *ÆSYLE*, *n. sp.*

(PLATE XIX, FIGS. 11-13.)

Bryozoum fan-shaped. Branches slender, rapidly diverging; from eight to ten in the space of five mm., but very slightly enlarging below bifurcations, which are frequent and irregular.

Dissepiments slender, from one-half to two-thirds the width of the branches; six in the space of five mm., but slightly expanding at their junction with the branches.

Fenestrules variable in size and shape, generally subquadrangular; width varying from once to three times that of the branches; poriferous side unknown.

*Formation and locality.* Lower Helderberg group, near Clarksville, N. Y.

FENESTELLA *IDOTHEA*, *n. sp.*

(PLATE XIX, FIGS. 14, 15.)

*Polypora elegans?* HALL. Twenty-sixth Rep. N. Y. St. Mus. Nat. Hist., p. 97. 1874.

Bryozoum palmate. Branches moderately strong, rounded, frequently and irregularly bifurcating; non-poriferous side unknown.

Dissepiments slender; width from less than one-half that of the branches to nearly equal; six in the space of five mm., scarcely expanding at their junction with the branches.

Fenestrules variable in shape, mostly subquadrangular; width slightly more than that of the branches; length from once and one-half to twice the width.

Cell-pores in two alternating ranges, opening nearly directly outward; openings circular or slightly oval; distance from each other equal to their diameter; three in space of a fenestrule; margins slightly elevated, scarcely indenting the borders of the fenestrules; space between ranges of pores not carinated; rounded; tortuously striated; dissepiments also striated.

*Formation and locality.* Lower Helderberg group, near Clarksville, N. Y.

FENESTELLA *ALTHÆA*, *n. sp.*

(PLATE XIX, FIGS. 17-19.)

Bryozoum—only fragments have been so far observed, so that the form of the whole frond is not certainly known. Branches slender; bifurcations compara-

tively distant, irregular; from seven to nine branches in the space of five mm.; on non-poriferous side rounded, striated; striæ fine, distinct; from three to seven on a branch.

Dissepiments slender, frequently oblique to the branch; four in the space of six mm., expanding at their junction with the branches, the expansion extending but a very slight distance from the branches.

Fenestrules subquadrangular; width varying from equal to two or three times that of the branches.

Cell-pores in two and three ranges; the central range opens directly upward, the two outer ranges nearly directly outward; cell-openings oval, five in the space of a fenestrule; distance from each other less than the diameter of an opening; margins scarcely elevated; at the junction of a dissepiment and branch there is frequently a cell-opening on the expanded portion of the dissepiment.

This species has, in some respects, very much the appearance of *F. crebripora*, but is of a much coarser growth, differing also in the number of ranges of pores.

*Formation and locality.* Lower Helderberg group, Albany county, N. Y.

#### FENESTELLA CREBRIPORA.

(PLATE XX, FIGS. 1-3.)

*Fenestella crebripora*, HALL. Twenty-sixth Rep. N. Y. St. Mus. Nat. Hist., p. 95. 1874.

Bryozoum, form unknown—this species having been seen only in fragments. Branches slender, distant; eight in the space of five mm.; on non-poriferous side rounded, striated, striæ fine, indistinct; bifurcations moderately distant.

Dissepiments very slender, oblique to the branches, six in the space of five mm.

Fenestrules subquadrangular; width from once and one-half to twice that of the branches, length frequently double the width.

Cell-pores in two ranges, large, oval, distance from each other less than their diameter, four in the space of a fenestrule, opening outward obliquely to the axis of the branch; margins not elevated; at the junction of the dissepiment with the branch, there is frequently a triangular cell-pore in the expanded portion of the dissepiment, opening directly upward; space between cell-apertures not carinated, though sometimes angular; finely striated; dissepiments also striated.

*Formation and locality.* Lower Helderberg group, Albany county, N. Y.

#### FENESTELLA SYLVIA.

(PLATE XX, FIGS. 4-7.)

*Fenestella Sylvia*, HALL. Twenty-sixth Rep. N. Y. St. Mus. Nat. Hist., p. 96. 1874.

Bryozoum large, funnel-shaped, rapidly spreading and radiatingly undulating. Branches very slender, closely arranged, twelve in the space of five mm.; non-poriferous side rounded, striated, striæ distinct, from three to five on a branch; sometimes the central striation is so large as to give a carinated appearance to the branch; bifurcations distant.

Dissepiments slender, from one-half to two-thirds the width of the branch ; nine to ten in the space of five mm., expanding at their junction with the branches ; on non-poriferous side rounded, on poriferous side angular.

Fenestrules small, subquadrangular to oval ; width from equal to the branch to one-half greater ; length from equal to the branch to twice its width.

Cell-pores in two ranges, small, round ; opening outward, at an angle of about 45° ; three in the space of a fenestrule ; margins elevated, slightly indenting the borders of the fenestrule ; space between ranges of cell-pores angular, but not carinated ; striated, and having in the centre a line of nodes.

*Formation and locality.* In upper layers of shaly limestones of the Lower Helderberg group, near Clarksville, N. Y.

#### FENESTELLA PHILIA, *n. sp.*

(PLATE XX, FIGS. 9-11.)

Bryozoum fan-shaped, undulating. Branches slender, closely arranged near base, becoming more distant above ; from twelve to sixteen in the space of five mm. ; on non-poriferous side rounded or slightly angular, apparently smooth.

Dissepiments from two-thirds to nearly equal the width of branches ; nine in the space of five mm., not enlarging at their junction with the branches ; on non-poriferous side rounded, and on the same plane as the branches ; on poriferous side angular and depressed.

Fenestrules subquadrangular, variable in width, length from two to two and one-half times the width.

Cell-pores in two ranges, small, round or slightly oval ; distance from each other greater than their diameter, three in the space of a fenestrule, opening nearly directly outward, except when occurring opposite the dissepiment, where they open nearly directly upward ; space between ranges of pores carinated, carina but little elevated, and having a line of nodes on the top ; nodes distinct, sharp, and about equal in number to the cell-pores.

*Formation and locality.* Lower Helderberg group, Albany county, N. Y.

#### FENESTELLA HESTIA, *n. sp.*

(PLATE XX, FIGS. 12, 13.)

A species with moderately strong branches and subquadrangular fenestrules. The non-celluliferous side is distinctly pustulose. The celluliferous side is unknown.

*Formation and locality.* Lower Helderberg group, Schoharie, N. Y.

#### FENESTELLA JUNCUS, *n. sp.*

(PLATE XX, FIGS. 16-18.)

Bryozoum probably cyathiform. Branches slender ; from eight to eleven in the space of five mm., frequently presenting a crowded appearance ; on non-

poriferous side rounded, except just below the bifurcations, where they are flattened; striated, striae fine, but very distinct, from five to seven on a branch; bifurcations distant, irregular.

Dissepiments, three in the space of five mm., slender; width one-half that of the branches, expanding very slightly at their junction with the branches; on non-poriferous side striated, and on plane of the branches; on poriferous side depressed.

Fenestrules subquadrangular, about four times as long as wide; width varying from one-half to a little more than the width of the branches.

Cell-pores in two ranges, round, distant from each other equal to or greater than their diameter, six in the space of a fenestrule, opening obliquely outward; margins distinctly elevated, and indenting the border of the fenestrule; space between ranges of pores subcarinate, carina narrow, elevated but slightly above the branch.

This species is easily recognized by the long, narrow fenestrules, and the slender and frequently crowded appearance of the branches.

*Formation and locality.* Lower Helderberg group, near Clarksville, N. Y.

#### FENESTELLA ADRASTE, *n. sp.*

(PLATE XX, FIGS. 20-22.)

Bryozoom fan-shaped. Branches moderately strong, eight in the space of five mm.; on non-poriferous side flattened, striated, from one to three striae on a branch; where more than one striation occurs, the one nearest the centre of the branch is much the stronger; very frequently only one striation occurs, in which case it is very strong, giving to the branch a carinate appearance.

Dissepiments about one-third the width of the branches, six in the space of five mm., much expanded at their junction with the branches.

Fenestrules-oval, width a little less than that of the branches, length from two to three times the width.

Cell-pores in two ranges, opening nearly directly upward, three in the space of a fenestrule; distance from each other less than the diameter of an opening, sometimes contiguous; cell-apertures circular; margins distinctly elevated, and indenting the borders of the fenestrules; space between ranges of cells carinated, carina sharp, height above the branch equal to the diameter of the branch.

This species is easily recognized by the flattened branches on the non-poriferous side, with the strong central striation giving a carinate aspect.

*Formation and locality.* Lower Helderberg group, near Clarksville, N. Y.

#### FENESTELLA CLEIA, *n. sp.*

(PLATE XX, FIGS. 14, 15.)

Bryozoom broadly cup-shaped. Branches somewhat rigid in appearance, from nine to eleven in the space of five mm.; on non-poriferous side subangular near the base, flattened above; bifurcations frequent.

Dissepiments very slender, eight in the space of five mm., width from one third to one-half that of the branches, not expanding at their junction with the branches.

Fenestrules subquadrangular, about twice as long as wide, width variable, but averaging a little less than that of the branches.

Cell-pores in two ranges, opening nearly directly upward; apertures large, circular, three in the space of a fenestrule, distance from each other equal to or less than the diameter of an aperture; margins distinctly elevated, but very slightly indenting the border of the fenestrules, apparently granulose; space between the ranges of pores occupied by a low, rounded ridge, but slightly elevated above the branch, and frequently a slight groove on each side of the ridge.

*Formation and locality.* Lower Helderberg group, near Clarksville, N. Y.

#### FENESTELLA THYENE, *n. sp.*

(PLATE XXI, FIGS. 1-5)

Bryozoum broadly cup-shaped, undulating. Branches strong, nine in the space of five mm.; non-poriferous side angular or subangular, obscurely striated; bifurcations moderately distant, irregular.

Dissepiments eight in the space of five mm., width slightly more than one-half that of the branches, expanding at their junction with the branches; on non-poriferous side of frond angular, on poriferous side rounded.

Fenestrules broadly oval or nearly round; the angularity of the branches and dissepiments on non-poriferous side give them an appearance more nearly circular than is really the case; width nearly the same as that of the branches, slightly longer than wide.

Cell-pores in two ranges, opening obliquely outward; cell-openings small, round, three in the space of a fenestrule, counting those opposite the dissepiment; margins elevated; space between the ranges of pores carinated, carina comparatively thick, elevated, about two-thirds the thickness of the branch, expanded above.

A single specimen of this species shows, at a distance from the base, the long, oval fenestrules, and flattened, striated branches.

This species, on the non-poriferous side, bears a close resemblance to *F. Coronis* (plate xxi, figs. 10-13), but is distinguished from that species by its more compact mode of growth, more slender branches, and smaller fenestrules.

*Formation and locality.* Lower Helderberg group, near Clarksville, N. Y.

#### FENESTELLA IDALIA.

(PLATE XXI, FIGS. 6-9.)

*Fenestella Idalia*, HALL. Twenty-sixth Rep. N. Y. St. Mus. Nat. Hist., p. 95. 1874.

Bryozoum cup-shaped. Branches moderately strong, closely arranged, eleven in the space of five mm.; on non-poriferous side rounded, striated, striæ very

distinct; from four to seven on a branch, frequently granulose; branches much wider below bifurcations; frequently four or five contiguous branches bifurcate at equal distances from the base.

Dissepiments from one-half to one-third the width of the branches, eight in the space of five mm., slightly expanding at their junction with the branches; on non-poriferous side rounded, on poriferous side angular, and deeply depressed.

Fenestrules small, subquadrangular, from three-fourths to once and one-half the width of the branches, length twice the width.

Cell-pores in two ranges, opening nearly directly upward; cell-openings small, round, three in the space of a fenestrule, distant from each other more than the diameter of an opening; margins distinctly elevated, and indenting the border of the fenestrules; space between ranges of pores carinated, height of carina nearly equal to the diameter of a branch; top of carina much expanded, especially below bifurcations, with a fine, sharp keel along the middle, and on each edge a row of nodes, which, when worn, present the appearance of minute pores or pits.

This species is distinguished by the compact and closely arranged branches.  
*Formation and locality.* Lower Helderberg group, Schoharie, N. Y.

#### FENESTELLA CORONIS, *n. sp.*

(PLATE XXI, FIGS. 10-13)

Bryozoum funnel-shaped, undulating, without fenestrules near the base. Branches strong, seven in the space of five mm.; on non-poriferous side generally angular, sometimes rounded, occasionally granulose, not perceptibly striated.

Dissepiments about two-thirds the thickness of the branches, five in the space of five mm., slightly expanding at their junction with the branches, angular on both sides.

Fenestrules variable in shape and size, from quadrangular to oval, and from equal to double the width of the branches.

Cell-pores in two ranges, openings circular, distant from each other less than the diameter of an aperture, three in the space of a fenestrule, opening nearly directly upward, partially concealed by the carina; margins distinctly elevated, indenting the borders of a fenestrule; space between the ranges of pores carinated, carina elevated more than the thickness of a branch, hollow, much expanded above, and having a thin, sharp crest.

*Formation and locality.* Lower Helderberg group, near Clarksville, N. Y.

#### FENESTELLA PRÆCURSOR.

(PLATE XXI, FIGS. 14-18.)

*Fenestella præcursor*, HALL. Twenty-sixth Rep. N.Y. St. Mus. Nat. Hist. p. 94. 1874.

Bryozoum deep, narrow, funnel-form. Branches strong, seven or eight in the space of five mm.; non-poriferous side generally flattened, gradually enlarging

to bifurcations, striated, striæ coarse, rounded, from two to three on a branch, frequently entirely concealed by granules, the branch presenting only a granulose surface; bifurcations few near the base, becoming more frequent and regular above.

Dissepiments about one-half the thickness of the branches, six or seven in the space of five mm., expanding at their junction with the branches, sometimes oblique to the branches; on non-poriferous side granulose, on plane with the branches; on poriferous side depressed, not extending above the ranges of pores.

Fenestrules from subquadrangular to oval, width varying from one-half to equal the width of branches in different fronds, or different parts of the same frond; length varying from double to little more than double the width.

Cell-pores in two ranges, opening directly upward or obliquely outward; openings circular, three in the space of a fenestrule, distant from each other more than the diameter of an aperture; margins elevated, very slightly indenting the border of the fenestrules; space between the ranges of pores carinated, carina elevated more than the diameter of a branch, expanded above, and having, in the middle of the wider portion, a thin, sharp crest, giving to the upper portion of the carina very much the appearance of a branch; the expanded portion has, on each side, a row of pustules, which when worn, present the appearance of ranges of minute cell-pores; occasionally, either on account of the more perfect condition of the frond or more advanced stage of growth, the pustules of contiguous carinæ are extended until they unite, forming slender bars connecting the carinæ; there are five pustules in the space of a fenestrule.

This species, when the pustules are extended into bars, has all the characters of the genus *HEMITRYPA*.

*Formation and localities.* On the surfaces of decomposing shaly limestone of the Lower Helderberg group, near Catskill and Clarksville, N. Y.

#### FENESTELLA QUADRULA, *n. sp.*

(PLATE XXI, FIGS. 19-22.)

Bryozoum funnel-shaped, rapidly expanding. Branches comparatively broad, nine in the space of five mm.; non-poriferous side flattened, striated, striæ sharp, distinct, generally three on a branch.

Dissepiments ten in the space of five mm., extremely slender, not expanding at their junction with the branches.

Fenestrules quadrangular, width about the same as that of the branches, length but slightly more than the width.

Cell-pores in two ranges, opening nearly directly upward; cell-openings circular, two in the space of a fenestrule, counting those opposite the dissepiment; margin elevated, slightly indenting the border of the fenestrule; space between the ranges of pores carinated, carina sharp, strongly elevated, abruptly expanding above, having in the centre of the wider portion a thin, sharp crest, and on each edge a line of sharp pustules, which frequently have the appearance of minute cell-pores, of which there are five in the space of a fenestrule.



This is a very distinctly marked species, and is easily recognized by its extremely slender dissepiments and square fenestrules.

*Formation and locality.* Lower Helderberg group, near Clarksville, N. Y.

### FENESTELLA (HEMITRYPA) NERVIA.

(PLATE XXII, FIGS. 1-6, AND ? 9, 10.)

*Fenestella Nervia*, HALL. Twenty-sixth Rep. N. Y. St. Mus. Nat. Hist., p. 93. 1874.  
*Hemitrypa prima*, HALL. " " " " p. 98. 1874.

Bryozoum broadly spreading, funnel-shaped, undulating on a line with the branches. Branches closely arranged, nine in the space of five mm.; on non-poriferous side rounded, apparently smooth, though better preserved specimens may show striæ; bifurcations frequent, irregular.

Dissepiments from one half to equal the thickness of branches, six in the space of five mm., widening at their junction with the branches; on non-poriferous side on the same plane as the branches, on poriferous side deeply depressed.

Fenestrules oval, generally from one-half to two-thirds the width of the branches, length twice the width.

Cell-pores in two ranges, opening obliquely to the axis of the branch; openings small, oval or circular, three to four in the space of a fenestrule, counting those opposite the dissepiment, generally one, sometimes two so situated; margins of upper portion of cell-pores distinctly elevated, of lower portion slightly elevated; space between ranges of pores carinated, carina sharp, elevated equal to the thickness of the branch, expanded above; expanded portion finely striated and having in the center a small sharp keel; crests of carinæ connected by a series of narrow, angular and striated bars, about fourteen in the space of five mm.

This species, in the study of more extensive collections, was found to include the forms previously described as *Hemitrypa prima*.

*Formation and localities.* Lower Helderberg group, two miles north of Clarksville, N. Y., and at Schoharie.

### FENESTELLA CLEIS, *n. sp.*

(PLATE XXI, FIGS. 7, 8.)

Bryozoum broadly cup-shaped. Branches closely arranged, moderately strong, nine in the space of five mm.; on non-poriferous side somewhat flattened; striated, striæ granulose, strong, from three to five on a branch; bifurcations comparatively regular.

Dissepiments six in the space of five mm., expanding at their junction with the branches, on non-poriferous side on plane of the branches; on poriferous side depressed.

Fenestrules small, oval, width from one-half to two-thirds the width of the branches, length from once and one-half to a little more than twice the width.

Cell-pores in two ranges, opening obliquely outward; openings small, round, three or four in the space of a fenestrule, distance from each other equal to or greater than their diameter; margins elevated; space between ranges of

pores carinate, carina sharp, elevated, slightly thickened above in well-preserved specimens.

This species resembles *F. Nervia* (pl. xxii, figs. 1-6), but the branches are straighter, giving a more rigid appearance to the frond, and so far as observed the carinae are never connected by bars as in that species.

*Formation and locality.* In the Lower Helderberg group, near Clarksville, N. Y.

FENESTELLA (HEMITRYPA) NERVIA *var. CONSTRICTA, n. var.*

(PLATE XXII, FIGS. 11, 12.)

This form differs from *F. Nervia* in the closer arrangement of branches and much smaller fenestrules, but it is probably only a variety of that species.

FENESTELLA (HEMITRYPA) BISERIALIS, *n. sp.*

(PLATE XXII, FIGS. 13-18.)

Bryozoum funnel-shaped, not rapidly expanding.

Branches ten in the space of five mm.: on non-poriferous side rounded, granulose, not perceptibly striated; opposite each dissepiment a node, which is frequently strongly elevated forming a blunt spine.

Dissepiments from one-third to two-thirds the width of the branches, seven or eight in the space of five mm.; on non-poriferous side slightly angular, on poriferous side rounded, on both sides depressed, expanding at their junction with the branches; oval or subquadrangular, nearly as wide as the branches; length once and one-half to twice the width.

Cell-pores in two ranges opening nearly directly upward; openings small, circular, three in the space of a fenestrule, counting those opposite the dissepiment; distance from each other equal to or greater than their diameter; margins elevated indenting the border of the fenestrule; space between the ranges of pores carinated, carina sharp, elevated about the diameter of a branch, expanding above; crests connected with each other by an extension of their substance in the form of slender bars; the bars of adjacent crests alternate with each other, forming midway between them a longitudinal ridge of a thickness equal to that of the bars, and leaving a double range of small fenestrules; twenty-three bars in the space of five mm.; top of carina rounded, obscurely striated.

*Formation and locality.* Lower Helderberg group, near Clarksville, N. Y.

ICHTHYORACHIS, *McCoy.*

ICHTHYORACHIS NEREIS.

(PLATE XXII, FIGS. 19-21.)

*Ichthyorachis Nereis*, HALL. Twenty-sixth Rep. N Y. St. Mus. Nat. Hist., p. 98. 1874.

Bryozoum plumose, midrib flattened on non-poriferous side, longitudinally striate with a groove along the center; lateral branches slender, distance from

each other equal to the width of the midrib; pores on all specimens seen, indistinct; two rows on the lateral branches with three or more on the midrib; length of largest specimen seen, seventeen mm.; width of midrib .5 mm.; branches about one-half as wide as the midrib.

This species is very rare and all specimens observed are imperfect and indistinct; as the specimens seen appear, they have the character of both *ICTHYRACHIS* and *GLAUCONOME*.

*Formation and locality.* Lower Helderberg group, Schoharie, N. Y.

### THAMNISCUS, *King*.

#### THAMNISCUS VARIOLATA, *n. sp.*

(PLATE XXII, FIGS. 34-46.)

Bryozoom fruticose; several stems arising from a common base; stems frequently bifurcating and spreading laterally, becoming very much widened before bifurcation, clavate, celluliferous on one side, smooth on the other or faintly marked longitudinally from the cell-tubes within.

Cell-tubes cylindrical, diameter at their aperture about .15 mm.; length three mm.; for most of the distance nearly parallel with the branches, then abruptly turning and opening directly outward; a row on each side of a branch opens laterally; in some places, especially just above the bifurcations, they are arranged in oblique rows—the distance between the rows about equal to the diameter of an aperture; the apertures forming the rows are contiguous, but generally they do not seem to be arranged in any regular order, and are frequently crowded; inosculating; margins much elevated; length of longest specimen seen, eighteen mm., greatest diameter two mm.

*Formation and locality.* Lower Helderberg group, near Clarksville, N. Y.

#### THAMNISCUS NYSA, *n. sp.*

(PLATE XXII, FIGS. 47, 48.)

Several stems arising from a common base, frequently bifurcating, celluliferous on one side, smooth or obscurely striated on the other, expanding but very slightly below bifurcations; diameter of largest stem seen, a little more than one mm.

Cell-tubes cylindrical, opening directly outward, diameter of aperture about .12 mm., margins distinctly elevated; regularly arranged in oblique rows across the branches; distance between rows equal to the diameter of an aperture; the cell-apertures forming the rows are nearly contiguous.

This species can be distinguished from *T. variolata* (pl. xxii, figs. 34-46), by the more nearly equal size of branches, not much enlarging below the bifurcations, by the smaller cell-apertures and their more regular arrangement.

*Formation and locality.* Lower Helderberg group, near Clarksville, N. Y.

THAMNISCUS NYSA, *var.*

(PLATE XXII, FIGS. 31, 32.)

The specimen has a mode of growth similar to the preceding species. The cell-apertures are somewhat smaller and not so closely arranged.

*Formation and locality.* Lower Helderberg group, near Clarkesville, N. Y.

THAMNISCUS FRUTICELLA, *n. sp.*

(PLATE XXII, FIG. 33.)

The only specimen observed is a small branching fragment of a frond, which has a very different mode of growth from the other species. The celluliferous side has not yet been observed.

*Formation and locality.* Lower Helderberg group, near Clarksville, N. Y.

THAMNISCUS? CISSEIS, *n. sp.*

(PLATE XXII, FIGS. 23-30.)

Bryozoum ramose, solid, celluliferous on one side, striate on the other; diameter of stem one mm.; branches numerous, equal in size to the main stem, and branching frequently, expanding very slightly below bifurcations: non-celluliferous side striated, striæ fine, numerous; cell apertures small, round or slightly polygonal from mutual proximity, their diameter about .25 mm.; generally four in the width of a branch, alternating, inosculating, forming very oblique rows; sometimes at the angles having minute spines.

Length of largest specimen seen, twenty-five mm.

*Formation and locality.* Lower Helderberg group, near Clarksville, N. Y.

FENESTELLA ———, *n. sp.*

(PLATE XVIII, FIGS. 21, 22.)

FENESTELLA ———, *n. sp.*

(PLATE XIX, FIG. 16.)



